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Electrical World

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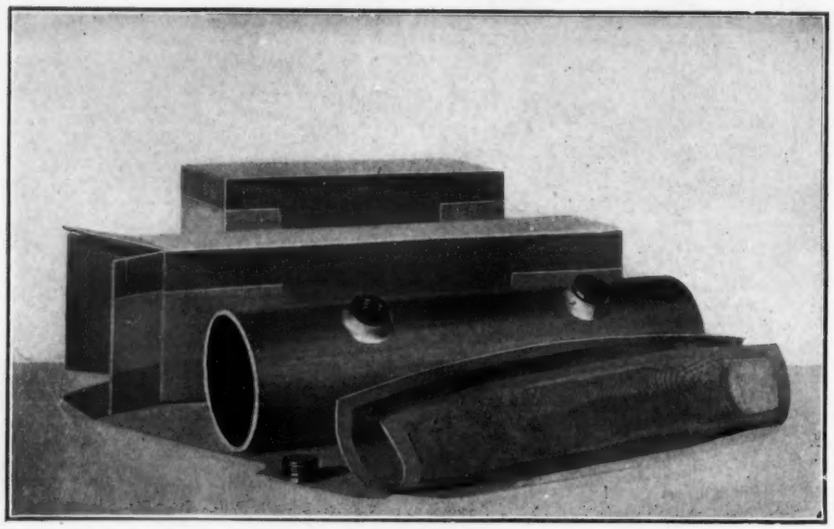

This standard package cable joint saves material. There is nothing to waste. It saves time. No trips need be made for materials forgotten. It saves money, being portable and easily installed.

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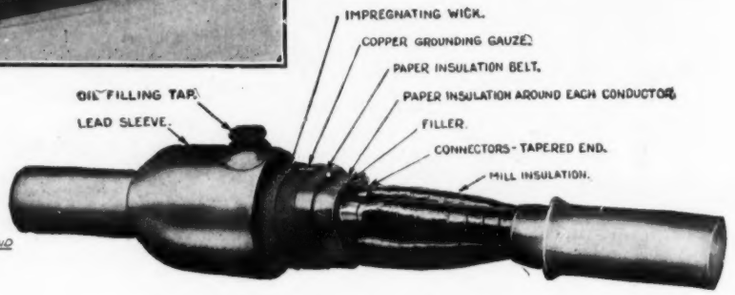
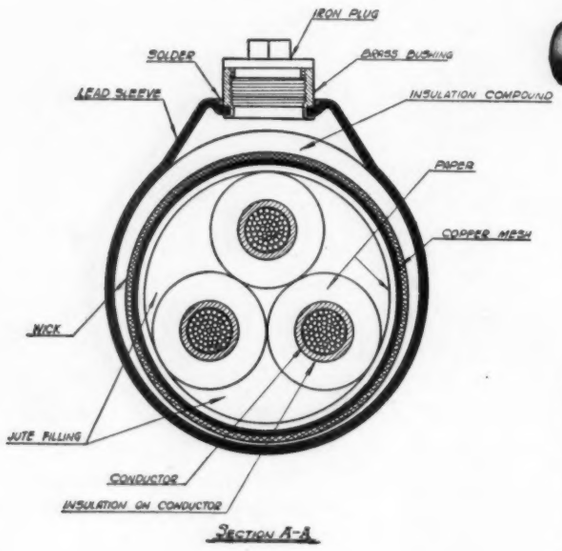


Detailed View Metropolitan Oil-Filled Cable Joint



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Electrical World

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR.
Editor

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Public Utility Securities and Savings Banks

IN MAKING available to the savings banks of Maine a list of securities which he considers legal investments for them, the bank commissioner of that state says: "On account of the difficulty in obtaining authentic information from city and town officials the municipal list is very incomplete. The present low yield of high-grade municipals, however, and the tax handicap on the purchase of out-of-state securities have combined to render the demand for municipals outside of Maine extremely limited. A few public utility securities which are probably legal do not appear on the list on account of similar difficulties in procuring information. The commissioner does not deem it wise to certify investments of this character except upon the sworn statement of responsible officers of the operating company as to the existence of the qualifying facts."

A glance at the list reveals more than a few electric public utility companies whose names are conspicuous by their absence. This certainly ought not to be. M. S. Sloan's committee of the National Electric Light Association is working hard in co-operation with banking institutions to have certain securities of public utilities made legal investments for savings banks. But it is useless to claim safety for bonds which, because of lack of interest on the part of executives—or, worse still, lack of value—cannot be passed by the bank commissioner of Maine. From a public relations angle, also, it is dangerous to offer bonds to employees and customers which are not up to savings banks requirements, and if the bonds cannot pass muster, what shall be said of the stock? Securities which are not good enough for savings banks are not good enough for the humble investor whose lifelong savings may be thus jeopardized.

Capitalize Upon Experience

THERE are two extreme approaches to the solution of new engineering problems—one through what might be called "desk analysis" and the other "follow the other fellow." In their extreme application either method is subject to criticism and in many cases results in excessive costs and poor engineering.

Most engineers approach a new problem in an open-minded manner and solve it by using all available opinions and data, and with the many properties now developed in this country it is usual to find that any design and operating problem has been encountered and solved by at least one property. It may be that no common solution will be found in complete detail, but certain fundamental principles will be found applicable to all problems of the same general character.

It is sound engineering to capitalize upon the experience and ideas of others by personal visitations, through reading technical articles and by making a study of committee reports. Any metropolitan system, for example, embarking upon a program of interconnection can do well to send engineers to study high-tension structure design and layout on properties which have had long experience with this type of system. A personal visitation gives the clearest conception of conditions and enables engineers to talk about their problems in specific terms.

The managements of properties should encourage their engineers to visit and study other properties and to devote time to reading articles and reports. Engineers should never become too self-sufficient to study the work of others engaged in similar lines of activity. Such a plan eliminates waste, promotes standardization and makes for the best and most economical engineering developments.

Salesmen Should Not Belittle Competitive Refrigerants

SALESMEN are enthusiasts. They must and should be so. Above all does the electric refrigeration salesman find inspiration for zeal and optimism. The world is smiling upon him. The industry and the public have both frankly accepted the idea of "ice by wire," and his way is made plain and smooth. It will be a very serious matter for him and for the industry, however, if competitive strife is permitted to interfere with harmonious co-operation in the educational development of the market.

The other day in a Western city a prominent local banker telephoned the vice-president of the electric power company and said that a salesman for another make of machine had told his wife that the gas used in his refrigerator was poisonous—was this true? In another city another salesman conceived the brilliant thought of carrying with him a bottle of a gas of an unpleasant odor but well-established usefulness in refrigeration. He uncovers it beneath the noses of prospective customers and says, "Smell this! Do you want that sort of stuff in your house?" Eagerness for orders has caused these young men to overlook the fact that their opportunity lies not in keeping a competitor from making a sale, but in helping to get more and more refrigerators into use. The problem is not to find customers, but to provide equipment to meet the demand.

Such incidents do not express the policy of any manufacturer. The spirit of the industry was clearly recorded at the meeting at Walden Woods in June, when the executives of the leading refrigerator companies met to form a co-operative association and pledged their organizations to a broad policy of constructive competition that would aim to promote improvement in equipment and provide the increasing production that the market needs above all else. It is clearly understood that primarily there is an idea to sell, and not merely a mechanical contrivance, and the great objective is to build up public confidence that electrical refrigerators are now practical and that it is safe to buy them. For any salesman to "knock" any

type of safe and efficient refrigerant employed in any dependable unit is an offense against the entire industry and a blow at his own employer. The truth of this cannot be too carefully expounded to all the selling men.

How Much Should Be Spent to Sell a Truck?

WHEN a man of capital sets out to buy a central-station property—which, after all, is just a business with an income—the question of price revolves entirely around the earnings that the system promises. The same philosophy should apply no less when a central-station business department sets out for an order for, say, an electric range or an electric truck. The value of that bit of load in profit on income to the service company should be the guide to how much it is good business to spend in developing a market and making the sale.

In Chicago it is estimated that the charging of an electric truck will bring in a profit of $1,000 to the central-station company during the lifetime of the truck. It is therefore considered reasonable that a generous portion of that amount per truck can be profitably appropriated to truck promotion and service, if the utility is going to promote the idea of storage-battery delivery wagons in the community and develop an off-peak charging load that will eventually be a profitable source of income. Eventually the truck will sell itself, like any other staple article of standard industrial or commercial equipment. Meanwhile, however, the value of the load should govern the amount of money that a company should spend in developing sales.

A High-Load-Factor Market Ready Made

THE remarkable development of the central-station industry during the past decade must not be allowed to obscure advancement made in other fields of enterprise and industry, because in many of these fields developments have taken place to create greater markets for central-station service at greatly improved load factors. The modern metropolitan hotel is a case in point. Not so many years ago the average city hotel was little more than an overnight lodging house with a modicum of facilities and services. Today there are building several hotels whose rooms number nearly 3,000 and whose facilities for personal comfort, convenience and luxury are not equaled in another country of the world. One of these, the new Palmer House in Chicago, will purchase all of its electric service requirements in the amount of 20,000,000 kw.-hr. annually. The connecting of this load to the lines of the power company is equivalent to adding a city of 40,000 population. But, what is of even greater interest, the load factor of this customer will be 60 per cent. This is a load factor higher than that of the average city of 40,000 people; in fact, this modern metropolitan hotel offers a market, ready-made, of a load factor surpassed by few central stations themselves.

As might be expected, the conditions of large power requirements at high load factor that make the metropolitan hotel an ideal central-station load also make it a likely prospect for a private plant. Add to this the insistence of private-plant advocates that the heating requirements of the hotel make possible the generation of power for little or nothing, and the problem of the power salesman becomes a real one. The fact that 95 per cent of Chicago's hotels buy their power would indicate that the power salesman has done a good job, but in doing this job three fundamental conditions surrounding hotel loads have been established: (1) The diversity of the demand for steam for power and steam for heating is so great that complete utilization of the exhaust steam available is impossible; (2) the combined lighting, power, cooking and miscellaneous electric load of the modern hotel is so great as to require twice the amount of steam for power generation that can be used for heating the building; (3) the first cost of a sub-basement hotel power plant is so great and the return on the investment so small, compared with the return on capital invested in the hotel proper, that no hotel owner can afford to sink an extra dollar in a private plant.

Plowing by Electricity

THE unremitting and systematic efforts on the part of operating companies, state experiment stations, farmers' organizations, joint committees, manufacturers, etc., to bring electric service to the rural population are beginning to bear fruit. It is reported from a few more progressive localities that the farmers are already "sold" on the idea of using electricity around the house and the barns, so that a steady progress in this direction may be expected. Lighting of the premises, electric washing and ironing, electric ranges, vacuum cleaners, milk refrigerators, general utility motors, etc., are the first applications which have required but little, if any, adaptation to farm service. Feed grinding, hoisting and drying of hay, milking of cows and similar more specifically farming operations are requiring some adaptation of the existing machinery and some educational work to show their advantages. When it comes to sawing wood, an average farmer can hardly be expected to buy the necessary equipment, which may require a comparatively large motor and a separate transformer. Some operating companies are planning to have such an equipment mounted on a gasoline truck and carried from farm to farm as the need arises. The equipment should include two long sticks for hooking directly on to the primary line, without climbing a pole, and a meter for energy consumption. Probably the company's man will have to supervise the equipment while the farmer feeds wood to the saw.

While operating and commercial engineers are thus applying electric power to the service around the farmhouse and the field, designers and inventors might well look into farther possibilities not realizable at present. Among these the most interesting and important problem is that of doing the field work, such as plowing and harvesting, by electric power. The electric tractor, as such, will present no difficulties, being simply a small low-speed electric locomotive, but there are other obstacles to be overcome, such as (a) the competition of the gasoline tractor, (b) a flexible power-supply cable between the primary line and the electric tractor, (c) a series single-phase alternating-current motor with a high starting torque. An individual farmer could hardly be expected to own such an equipment outright, but, with diversified crops, several farmers together, or the power supply company, could utilize one with a fairly steady service during several months in the year. The principal engineering prob-

lem is that of delivering electric power to the tractor while it is dragging an agricultural implement back and forth (or in circles) over the field. A cable reel carried by the tractor and wound and unwound automatically with its motion, as in some mine locomotives, is one solution. However, one may hope that inventors will not limit themselves to pouring new wine into old bottles, but will start directly with the problem of placing crop seeds under ground and will do this electrically in the best manner compatible with the properties of the new motive power.

High-Voltage Insulator Research

THE problem of the proper design for high-voltage lines has been ever present and continually changing as the values of transmission voltage have increased. At first sight there is an element of surprise in this because the fundamental laws of high-voltage insulation are very well understood. It has long been known that the best shape of insulation is that in which the surfaces of the insulating material are perpendicular at all points to the equipotential surfaces of the field. Unfortunately, however, this simple principle cannot be applied under the conditions obtaining in high-voltage lines. On the one hand, at the high values of voltage used it is not possible to form the insulating material into the sizes and shapes indicated by theory, and, on the other, were they so constructed they probably would not stand up mechanically to the stresses imposed upon them, nor would their life be long under the variations imposed by atmospheric conditions.

Hence we have the divided insulator unit, leading to the well-known chain, or suspension, type. This passage to a multi-unit insulator has added further unknown factors to the problem, and as a consequence the design of insulators is largely an empirical matter rather than a problem based on theory. As is well known, the large number of metal parts, their unsymmetrical shape and their relation to the insulating elements make it possible to foresee the exact distribution of the electric intensity in the regions surrounding the insulating elements. This distribution of the electric field in the neighborhood of the insulating surface, however, is probably the predominating factor in the value of the flashover voltage of the insulator. Consequently a number of efforts have been made to study the distribution of the electric field about the string.

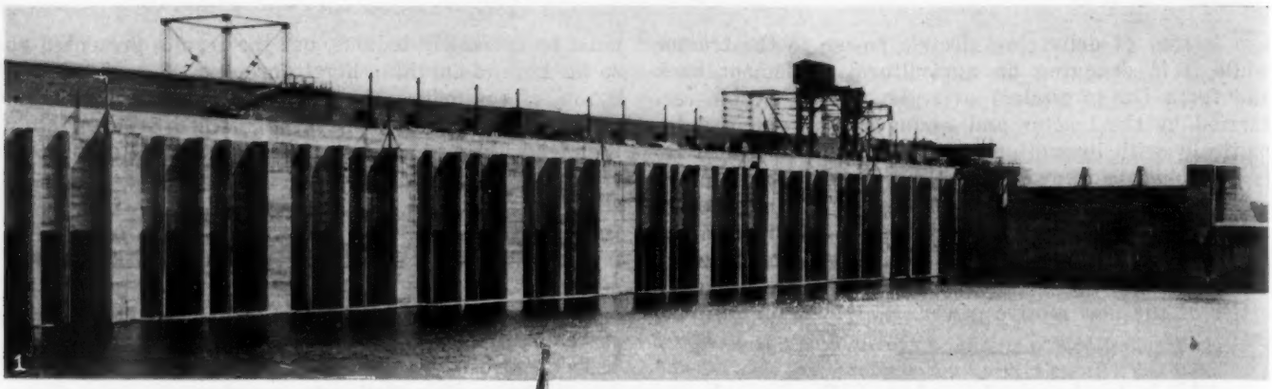
The results of these efforts for the most part have been approximate only, and particular interest therefore attaches to the very careful and thoroughgoing investigation upon the shape of the entire field of each of several insulators appearing in recent numbers of the *Elektrotechnische Zeitschrift*. The method followed is the use of a small electric compass, as it were, of which the principal element is a short piece of dry straw free to turn and which is supported at any desired point near the insulator string by two dry silk threads. The straw takes up accurately the direction of the field. Its position and direction are recorded by projecting the shadow of the entire string, as well as that of the compass, on a screen upon which the lines of force must then be plotted. Measurements of the intensity of the field are made in similar manner by very small vacuum tubes which come to a glow at definite values of voltage. With these two simple instruments it was found possible to plot with great precision the complete field of the insulator string in different planes. The process must be extremely tedious, but the results presented go so far beyond anything heretofore seen, as to the distribution of the field around the insulating members and their metal supports, that the method will certainly commend itself to all designers of this vital element of transmission systems.

How Far Are Independent Station Designs Justified?

GENERATING station design is passing through an extraordinary period of transition. Even the casual engineering visitor to a modern group of plants cannot fail to see this, and it is no mean task for the power-plant specialist to keep abreast of progress in fuel-burning installations, to say nothing of the developments of recent hydro-electric applications. The race for ultimate minimum cost of production is swift, and the point was well made at the recent Saratoga convention of the A. I. E. E. that this minimum cost is not expressed in B.t.u. per kilowatt-hour at a stated coal price, but in total fixed charges and operating expenses per unit of production. In order to realize the economies of production now available, much original designing has had to be done. More will follow in the future as experience with reheating, higher steam pressures and heat-balance control mounts up, and the temptation with every new plant and often with enlargements of older installations is strong to introduce "something different" in equipment or arrangement.

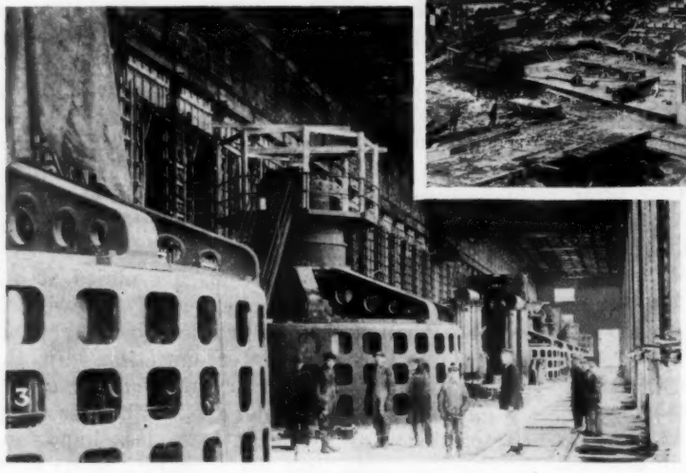
So long as these variations are aimed at operating economy, their regional effect is of somewhat less importance than are those features bearing upon intersystem operation and interconnection. In the more settled parts of the country the builder of a central station today faces broader responsibilities than of old. The efficiency of his plant is of less importance to a geographical area than the reliability of its service and the capacity which it may be able to deliver into a transmission network at different times. Because of this the influence of interconnection upon station design should be one of the most profoundly important considerations in the minds of those who finance, design, build and operate the complex assembly of apparatus which forms the working essentials of the modern steam or hydro-electric plant. To build a station totally independent of present or prospective electrical neighbors (and sometimes this has been done within a few miles of another capable of meeting all the demands of a large territory at fair costs for years) is to take one's regional responsibilities lightly indeed.

The day is close at hand when even semi-competitive owners of generating stations will sit down at a common table as a routine matter before embarking upon new developments designed with little thought of how these plants will work into the regional scheme of load carrying and intercompany ties. Waste of any sort brings no honor to those responsible for it. Fortunately there is an immense field for the exercise of independent judgment and originality of design in the present state of power-plant evolution without jeopardizing the ability of a station to work in economic and service harmony with its neighbors. The plant owner who builds a wall of isolation into a design in which he does exactly as he pleases without regard to future relations with neighboring properties takes a very heavy responsibility upon his shoulders.



Saguenay River Largest Single Water-Power Installation

AT ILE MALIGNE, on the Saguenay River, Province of Quebec, Canada, the Duke-Price Power Company, Ltd., is undertaking the installation of 540,000 hp., of which 360,000 hp. is completely and 180,000 hp. partially installed. The power company is permitted to utilize the storage capacity of Lake St. John between ordinary low water and high water, which is estimated to be 187,100,000,000 cu.ft. in a depth of water of 17.5 ft.



The power-house design calls for the installation of twelve vertical shaft, single-runner, Francis-type turbines operating at 112.5 r.p.m.

Each unit has a continuous full load rating of 30,000 kva. at 13,200 volts, three-phase, 60 cycles. The range in head is between 100 ft. and 120 ft.

The accompanying illustrations are published through the courtesy of the Canadian National Railways.

1. Left channel of dam.
2. View of power house and portion of dam.
3. Generating room, which when completed will contain twelve 45,000-hp. turbines.
4. Spillway No. 4 in the right channel.

Locating Defective Insulators

New Type of Live-Line Testing Stick Permits Quantitative Comparisons—Direct-Reading Device that Is Light, Portable and Safe—Adaptable to Testing Any Type Insulator and Applicable to Other Purposes

By GEORGE A. ILER

Chief Electrical Engineer Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio

AFTER a high-tension transmission line or substation has been built, uninterrupted service is attained largely by the operators being able to locate dirty or defective insulators, and either to clean or to remove them before they cause an interruption. If insulators that are only partly bad can be located and distinguished from very faulty insulators, they may be left in service a while longer if they are on a comparatively unimportant line. If for economical reasons the expense of changing them must be deferred, a big saving in maintenance expense can be shown by replacing the totally bad units and watching the partly defective ones by retesting periodically thereafter.

Most transmission and operating engineers test all high-tension lines once annually, if possible. This creates a sense of security, a good talking point for the new-business department, and provides more continuous service, as is shown conclusively by the records of public utilities that have tested insulators annually in the past. Some electric service companies have enough lines to make it possible to remove one line at a time from service for testing insulators. Others, however, are not so fortunate. For these, a safe and rapid method of testing by unskilled men whenever desired, which will not disturb the operation of lines, is an absolute necessity, becoming more and more important as the load and voltage are increased on the line and as the system network expands.

Such a device has been developed and is in use on several systems primarily for testing and determining the condition of high-voltage insulators on live lines or substations and for testing all high-voltage bushings on oil circuit breakers and transformers. During the first four months this device was available it was adopted by seven different properties of the Ohio Public Service Company and by three different properties of the Pennsylvania-Ohio Power & Light Company. It has also been used by the West Penn Power Company, the Duquesne Light Company and the Northern Ohio Traction & Light Company. It is being used for making preliminary tests prior to a decision upon its adoption by the Kentucky & West Virginia Power Company, Logan, West Va. Demonstrations have been presented before numerous engineers and operating men to show performance. Some comments and experiences are related later in this article.

Device Gives Visible Indication

Unlike other methods of testing insulators, of which there are several on the market, this device does not depend on an audible signal, but affords comparative readings directly on a visible scale. The instrument calibration is such that the unit is shown as "good" if it carries approximately its normal voltage (depending upon its position in the string) and as "partly defective" if the voltage is slightly below normal and as "bad" if the voltage is well below normal. Therefore several persons may test the same insulators and get the same results, whereas conclusions based on testing devices giving faint audible signals vary greatly due to different insensitiveness of the operator's ears. Audible signals may be difficult if not impossible to read at all if there is any noise near by such as the wind blowing through overhead wires or steel tower work, passing trains and traffic, or, worse still, if the signals are very weak, which is quite sure to be the case if the line is overinsulated.

The accompanying illustration shows the relative potentials that will exist when the test stick is brought into contact with a metal cap or cement between insulator shells when different numbers of units are defective.

PORTION OF TEST STICK CARRYING ALL APPARATUS USED IN TESTING

In developing this instrument it was decided that the simplest way to detect faulty insulators was by utilizing the line voltage to charge the several units of an insulator as a condenser and then measuring the voltage across the units. Insulator units in which a defect is developed do not carry their normal share of the total voltage between the line and ground. Hence it is more logical in searching for defective units to measure the potential gradient and determine how the insulator performs under the actual operating conditions than to determine the performance from measurements made with the insulator dead and with the use of more or less delicate and complicated apparatus. Consequently the new device is designed to give an indication of the potential to ground at any point along the porcelain hardware of an insulator, and is so calibrated that the voltage necessary to produce deflection varies with the voltage to ground according to the characteristics of the insulator string to be tested.

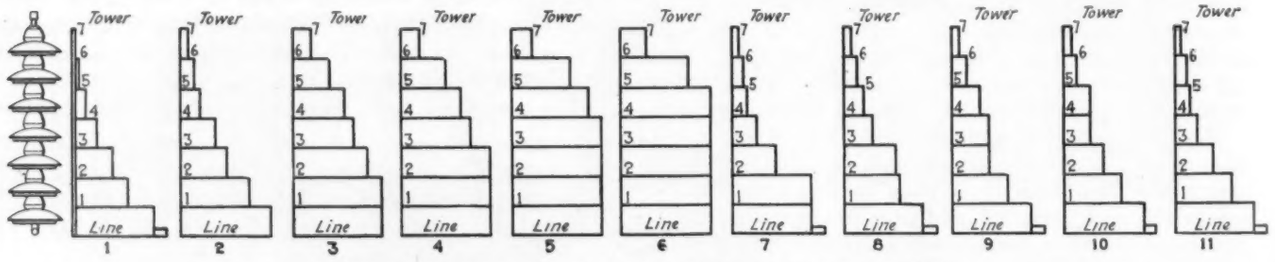
This device may be used for testing the condition of long, solid porcelain units such as bushings, as well as long insulating units composed of numerous porcelain sections cemented together, such as those used on transformers and oil circuit breakers. By touching the test stick to the bushings at the live end and gradually testing at numerous points along the insulators the exact potential gradient may be determined and a record thereof plotted, so that at any future time another test may be made to show the deterioration or effect of gradual accumulation of dirt. Or, better still, a record may be made of each test over a long period, during which time periodical tests are made on the same insulator under the same conditions and a quantitative analysis made, showing the deterioration of the insulators. Such a test is very important from an engineering viewpoint, because it has never been possible heretofore to make a quantitative analysis of the deterioration of insulators in order to determine which make of insulators is best suited to the purpose, except by the usual laboratory tests, which are apt to give quite different results from those made in the field under service conditions. With this device it is conclusively demonstrated that the second insulator from grounded end of a string of insulators is subjected to little if any potential strain. Therefore it may be possible to save considerable money on new construction by using an insulator unit in this position having lower dielectric strength and flashover voltage. As it is possible to determine which insulators are slightly defective and which are entirely bad, it is possible to utilize the slightly defective insulator for longer periods, instead of throwing them out with the bad insulator, in this way reducing maintenance expense. Partly defective insulators are indicated so clearly and definitely that there is no doubt left in the operator's mind, as might be the case with other testing devices.

Live-line testing may be done either by one man working alone, or by man and a helper. There is probably no real necessity for the attendant other than legal or other considerations which make the use of a helper advisable. In such cases the work may be arranged to utilize the other man to advantage by having him inspect the poles and steel towers for their physical condition while the test man is examining insulators.

OTHER USES FOR NEW TEST STICK

While the importance of knowing the condition of transmission line insulators is quite generally recognized, the necessity of testing circuit breaker bushings, transformer bushings and all bus work insulators at substations is not so generally observed, possibly because they are more likely to be under constant attention, or because it is thought they can be replaced more readily. However, if it is assumed that a substation has four important transmission lines radiating from it, continuity of operation of the substation is four times as important as any one of the lines leading to it. Therefore it becomes important to watch over the insulators and bushings at substations very closely, making tests every thirty days on all insulators in order to determine when to clean off the insulators and to renew partly defective ones. If leaky insulators can be located and the cause determined before trouble occurs, it is an easy matter to clean and replace such insulators, either with the line dead or by modern live-line methods.

Various other applications of the new test stick will present themselves to the imagination of an operator. One stick may be kept at each substation on the system to be used as a substitute for a high-tension voltmeter with its step-down potential transformer when necessary, as the instrument on the test stick may be calibrated to read directly in line voltage. By simply hanging it on one phase of the line it will accurately give a continuous reading of line voltage to ground.



POTENTIAL TO EARTH WITH VARIOUS INSULATOR UNITS DEFECTIVE

No. 1—No. insulator units defective.
No. 2—No. 1 insulator unit totally defective or dead (zero megger reading).
No. 3—Nos. 1 and 2 insulator units totally defective.
No. 4—Nos. 1, 2 and 3 units totally defective.
No. 5—Nos. 1, 2, 3 and 4 units totally defective.
No. 6—Nos. 1, 2, 3, 4 and 5 units totally defective.
No. 7—No. 2 unit totally defective.
No. 8—No. 3 unit totally defective.
No. 9—No. 4 unit totally defective.
No. 10—No. 5 unit totally defective.
No. 11—No. 6 unit totally defective.

INSULATORS TESTED BY TWO METHODS

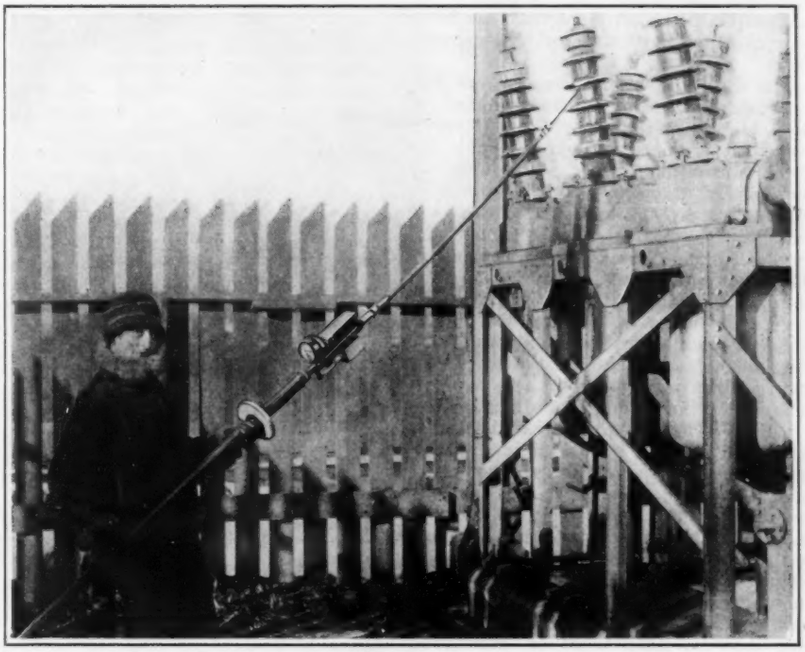
(From E. W. Billman, distribution engineer Ohio Public Service Co. Loraine, Ohio)

Insulator No.	Megger Test, Megohms			Iler Test, Dial Divisions				Tested by
	Top	Shell	Pin	Line	Top	Shell	Pin	
16	0	0	Inf.	19	16	18	4	O.P.S. Co.
17	0	0	Inf.	19	16	12	2	O.P.S. Co.
11	0	0	Inf.	19	16	13	5	O.B. Co.
18	5	30	600	21	16	11	2	O.P.S. Co.
19	75	400	Inf.	21	16	14	4	O.P.S. Co.
20	0	0	Inf.	20	15	17	4	O.P.S. Co.
8	0	0	Inf.	19	15	15	4	O.B. Co.
3	125	8	Inf.	19	14	13	3	O.B. Co.
10	0	Inf.	Inf.	18	14	11	4	O.B. Co.
21	400	500	2,000	20	14	12	8	O.P.S. Co.
22	80	40	1,500	20	13	11	8	O.P.S. Co.
23	1,000	0	Inf.	20	13	14	4	O.P.S. Co.
24	600	500	250	20	12	10	4	O.P.S. Co.
25	300	0	600	20	12	12	9	O.P.S. Co.
26*	800	800	1,000	20	12	8	2	O.P.S. Co.
27	400	0	Inf.	22	12	12	11	O.P.S. Co.
28	600	600	Inf.	20	12	9	8	O.P.S. Co.
15	0	0	Inf.	18	12	10	4	O.B. Co.
1	Inf.	4.2	Inf.	19	11	10	5	O.B. Co.
7	0	0	Inf.	19	11	9	3	O.B. Co.
9	0	2.6	Inf.	19	11	15	4	O.B. Co.
29	0	0	600	20	11	8	6	O.P.S. Co.
12	0	0	Inf.	19	10	4	2	O.B. Co.
2	12.5	0	Inf.	18	10	4	2	O.B. Co.
5	Inf.	0	Inf.	20	9	9	3	O.B. Co.
14	0	0	Inf.	19	9	4	3	O.B. Co.
30	125	150	500	20	9	9	8	O.P.S. Co.
31	80	5	30	20	9	7	11	O.P.S. Co.
4	Inf.	Inf.	25	19	8	4	2	O.B. Co.
6	0	0	Inf.	19	8	11	4	O.B. Co.
13	350	Inf.	Inf.	19	5	9	2	O.B. Co.
32†	Inf.	Inf.	Inf.	21	8	4	3	O.P.S. Co.

* 26 and others show deterioration or defect on one or more petticoats.
† 32. Good insulator used as a standard to compare tests.
Inf., Infinity; O.P.S., Ohio Public Service Co.; O.B., Ohio Brass Co.

It will also register line disturbances and indicate the magnitude thereof. By being connected to a graphic instrument, it can be used as a surge recorder in substations or generating stations, thereby enabling the load dispatcher, by calling the various stations, to ascertain very quickly the exact territory where the origin of the line trouble is. The test stick may also be used for ascertaining if a line is "alive" with full voltage or part voltage. When the stick is used as a voltmeter by hanging it on one of the phases of the line, no other connections are necessary to ground to other phases. It also provides a means of obtaining quick and accurate readings of phase voltage in order to determine unbalanced conditions or which one of the phases is high or low.

There is also the possibility of insulator manufacturers attaching a test stick to a graphic voltmeter for making tests on new insulators as they pass the device on a continuous moving belt. A graphic record of the condition of each insulator might be given the purchaser of insulators in order that he may know the percentage of bad insulators coming through the factory at the time of his delivery—information that is very important but not heretofore obtainable.



AT LEFT, TESTING STRAIN INSULATORS WITH LINE "ALIVE" WITH VISIBLE INDICATING TEST STICK. AT RIGHT, TEST STICK IS LIGHT ENOUGH FOR WOMAN TO HOLD COMFORTABLY

FEATURES OF TEST DEVICE

In general, the insulator-testing device consists of a long stick with a minimum length of 10 ft. Extensions are possible for extra high voltages. At the tip of the stick is a detachable metal contactor. Several different shapes may be used to adapt it to different types and shapes of insulators. In testing pin-type insulators, it is important that the contactor be applied to the cement between the units. With the test stick it is impossible to short-circuit a good insulator, which might be the only good one in the string, as there is only one spike on the end of the test stick, and only one point on the hardware of the insulators can be touched at any one time. Back from the tip several inches is a metal joint carrying a metal ring for attachment of a hand line so that testers can hoist the stick when they are working in difficult positions overhead. The metal joint also provides attachment for a paint brush, useful in marking bad insulators after they are located so that linemen can later identify and replace them. From this ring holder to within a few inches of the testing apparatus proper is a micarta tube, which withstands a dielectric puncture test of more than 450,000 volts. It contains a small wire that conveys the potential from the contactor down to the instrument proper, which is about midway of the pole. Between this micarta tube and the portion of the pole carrying the instrument is a screw joint for sectionalizing the pole when not in use to permit convenience in transportation.

The instrument proper consists essentially of a radio amplifier circuit, in the plate circuit of which is the instrument giving the direct reading. The amplifiers are not directly connected with the contactor on the end of the test stick, but are isolated therefrom by an inductively coupled winding. Other connections are provided for detecting electrical leaks in transformer windings, transformer bushings, sparking brushes on motors, electrical leaks from the underground cables, street-lighting circuits, etc., where there is an actual spark, either visible or invisible, regardless of how small the spark may be.

Provision is also made for connecting graphic instruments. The actual works of the test stick are contained in a small Bakelite box, all of the apparatus being of miniature design. The voltmeter has a special dial and special pointer, which makes it very easy to observe readings at a distance of 10 to 15 ft. Between this equipment and handle of the test stick is a micarta insulating section (provided in different lengths, depending on the voltage of the line test) and a 7-in. fiber disk, which can be moved up and down the stick and securely fastened in any position to guard the operator. For testing insulators on circuits up to and including 66,000 volts, the insulating section is about 12 in. long.

The handle proper is kiln-dried, boiled in paraffine oil and then shellacked. The complete device weighs 14 lb. The instrument shown is suitable for all voltages from 2,000 to 132,000 volts. Above and below these voltages it is necessary to change the voltmeter for another one of different calibration, but this may be done in a few seconds, as the instrument is attached by a small butterfly nut.

Comments of Some Users of Iler Testing Equipment

Following are some comments sent to others than the writer by engineers who have had some experience with the new insulator testing method:

We are using the Iler live-line insulator-testing equipment on all of our divisions. Our men seem to be very well pleased with the results and there is no doubt in my mind that they are securing much more accurate results with this equipment than we have ever obtained by the use of other equipment.

The most important requirement for an insulator-testing device is that it shall eliminate the possibility of error due to the operator being unable to check himself definitely. We found in the use of devices which required a comparison by the ear, that there is a tendency to indecision on the part of the operator. Another requirement is that the equipment shall be safe to handle and that it does not short-circuit the units in the insulator. The Iler test stick seems to be entirely safe, does not short-circuit insulator units, and requires only that a man be capable of reading the number of divisions on a meter. These readings can be tabulated and checked by an engineer, who determines the condition of the insulator. In our experience so far, all insulators which were changed proved bad when they were subjected to megger and high-potential tests in the laboratory. The only way we have of knowing that insulators which tested good on the line were good is by the fact that no flash-overs or punctures have occurred since the line was tested and the bad insulators removed. The principal fault in pin-type insulators is the presence of minute cracks in the head. These occurred more frequently in insulators manufactured from eight to ten years ago.

This testing work is carried on by two men. One climbs the pole and operates the stick and another tabulates the readings on the ground. The only limitations to the use of this equipment are stormy weather and damp fogs. An attempt is always made to carry on this work during dry weather.

The Iler device seems to meet practically all requirements for an ideal testing stick.

Our linemen are very well pleased with this device, principally on account of its simplicity and the definite results which they can obtain by its use.

GEORGE E. SNIDER,
Chief Electrical Engineer,
Ohio Public Service Company,
Cleveland, Ohio.

The Iler test stick does not give quantitative measurements of potential to ground across suspension-type insulators, but it does give comparative indications which can be expressed in percentage as regards the gradient on insulator strings. When repeating measurements under the same conditions, the average diversion is very small. There is no tendency toward a misreading, due to accumulation of dirt on the surface of the porcelain insulators. Where such conditions have been found, it is a notification that we should make a thorough cleaning of this particular porcelain.

The only disadvantage or danger to the operator in so far as we have been able to observe are none other than the usual danger to which one is exposed in making tests where they are concerned with high-voltage equipment. Inasmuch as all the apparatus is mounted on a mid-section of the test stick, there is no more danger in using it than there is in using the ordinary switchpole so long as this section of the stick is kept clear of the other phases and grounds.

The Iler test stick has quite a number of applications other than those for which it is primarily intended. We have used it to test porcelain which includes pin-type insulators, suspension-type insulators, both post and pillar-type bus supports, oil circuit-breaker bushings, transformer bushings, potential transformer bushings and current transformer bushings. Another use for this test stick is locating the particular phase on which there is some disturbance. It will also pick up surges on a line as small as that which is caused by the charging of a 22,000-volt electrolytic lightning arrester. The results have been very satisfactory and superior to anything which we have used heretofore.

Our experience in connection with this test stick has covered a large range of voltages up to and including 132,000 volts.

We have not gone entirely through our system with this method of testing yet, but we hope to find that it will aid us materially in determining maintenance as regards our porcelain insulation.

E. E. HUNTER,
Superintendent of Distribution,
Ohio Public Service Company,
Warren, Ohio.

We are now operating one of the Iler live-line test sticks on our system and find it far superior to any other testing device we have ever used.

We have tested a number of our insulators and have changed quite a few shown to be bad by the stick and found that they had small cracks in the head or top petticoat. Insulators that showed the same readings, when taken down were all found to have similar cracks.

In order to determine the human factor we had one man use the device for two days until he had become thoroughly accustomed to the instrument, then he tested a short section of line and tabulated the readings. The next day another man was sent out with the stick who had never seen it before. He was shown how to operate it and the same section of line was tested and the readings tabulated. When a comparison was made they corresponded within one or two points. The first day was clear and warm and the second day was cloudy and damp.

This instrument, as we see it, is very effective in locating defective porcelain and can be used in many other ways as stated by Mr. Iler. I believe as time goes on that this insulator tester will become an operating necessity in large electric service companies.

R. L. GORDON,
Distribution Superintendent,
Kentucky & West Virginia
Power Company,
Logan, W. Va.

After making tests on 22-kv. line insulators over a period of several days, I believe the Iler set is the best we have used from the standpoint of dependable tests. We have tested at various points to see if there is any appreciable difference with regard to load on the circuit and find that this makes but little difference.

We took fifteen insulators to the Ohio Brass Company for tests after we had made tests on them with the Iler set. They used a 1,000-volt megger in making their tests and showed that these insulators were defective. Since that time we have made tests of insulators on the line with the Iler test and removed approximately 100 insulators. These were brought to the shop, where tests were made with a 1,000-volt megger to check the line tests.

I am convinced that we can pick out defective insulators with very close accuracy, if such tests are made systematically. The Iler test set is very sensitive, but caution should be used regarding the clearance or angle of the stick, especially when testing on pole tops, where it is necessary to extend the test stick between phase wires, or within close range of ground wire or other ground sections such as steel supports.

When testing pin-type insulators, care should be taken to make contact on the cement.

I am attaching a sheet showing some tests taken with the Iler stick that were checked with a megger.

E. W. BILLMAN,
Distribution Engineer,
Ohio Public Service Company,
Loraine, Ohio.

Experience on the Pennsylvania-Ohio Power & Light Company's system shows that a man and helper can test two miles of single-circuit or one and one-half miles of double-circuit transmission lines with this device at a cost of 8 to 10 cents per unit under union labor conditions on the system.

Interpreting "Big Business" to the Public

Carries Curse of Early Mispractices—Outruns Understanding of General Public — The Service, Capital, Return, Confidence Circle — Holding Companies Are Investment Companies — Need of Massed Capital — A Reciprocal Confidence

An Interview with
MARTIN J. INSULL
Middle West Utilities Company

OUTSTANDING utility problems marshal the attention of executives in varying degrees, all being given consideration, but some more than others, depending to a great extent on the inherent characteristics of the man. In the case of Martin J. Insull, president of the Middle West Utilities Company, his whole personality radiates confidence and friendly relations. This is probably why he has concentrated so much of his attention and activities on public relations and what it means to utilities and the public. Interviewed recently on this subject by a representative of the ELECTRICAL WORLD, Mr. Insull directed his remarks particularly to the effect which so-called "big business" has on the public. He pointed out the danger of letting any business activities outrun public understanding, and presented some views on the relation of service to capital, to return, to confidence, on the value of holding companies and massed capital to the public, and the necessity of publicly recognizing the problems of businesses outside utilities if the latter expect to receive fair treatment.

MARTIN J. INSULL

Commenting on the cause of public agitation against big business, Mr. Insull said: "It is due to a lack of public confidence therein, caused largely by public ignorance, and to some extent by the abuses of 'big business' in the past. In its early days there was the stifling of competition, resulting in restaint of trade, get-rich-quick financing, and all the abuses that necessarily, to some extent, accompany every revolution—even the best—on its way to the final good which it ultimately accomplishes. The last twenty years have seen a beneficent change in our ethical view of business. The day of business for 'profit alone and let the public take care of itself' is past; in its place has come a much higher spirit of business—the spirit of service to the public, humanitarian treatment of employees, with fair return to them and to the capital invested.

"No business, be it small or large, can be a success finally unless the public has confidence in it and its management. No honest man cares to be engaged in any pursuit in which he feels his fellow men have no confidence. On the other hand, this confidence cannot exist unless a full understanding of business is given to the public, and that can come only through business men themselves informing the public with regard to the fundamentals of their particular lines of activities. We must offset the possible danger, and one that now exists, of businesses growing so large they outrun public understanding, by using every means in our power to bring about a correct public understanding.

"The public must be made to understand," Mr. Insull pointed out, "that the constantly increasing demand for utility services cannot be satisfied without constantly increasing the facilities for furnishing these services. These increased facilities cannot be provided without increasing the capital invested in the necessary facilities for these services. The constantly increasing capital cannot be supplied through the earnings from these services, which are by regulation, either state or federal, or by public opinion, limited generally to only a fair return on the capital invested in facilities used and useful for the public service. Therefore, to provide this increased capital, new money has to be constantly secured. This new money can come only from the investor.

"The investor will not put his money into a business that has not the confidence of its customers—the public. Therefore for the public to secure the constantly increasing transportation, communication, light, power and heat service it requires, these essential services must have public confidence. To secure this confidence, those engaged in these services, during the past few years, have taken every legitimate means they could to enlighten the public on all phases of their business. Some have gone even further, and have invited the members of their customer-public to become financially interested in the companies that serve them. This is leading to the best kind of public ownership—industry

owned by the customers it serves, operated with the skill, energy and initiative of private operation, as compared with the lax methods of political ownership and operation."

The opinion was expressed that the public should more generally be apprized of the fact that there are 2,500,000 investors interested in the electric light and power business of the country. That there is every reason to believe that this number in the next few years will be increased several times, as that industry today has more than 16,000,000 customers, all of whom are potential stockholders in this great essential service.

"Holding Companies" Are Investment Companies

"In some people's minds arise considerable doubt and criticism regarding what are termed 'holding companies,' but which are really investment companies in the public-service field," Mr. Insull continued. "This, probably, is due to a lack of appreciation by the public of the enormous amounts of capital required and used to give it these essential services. These large amounts of capital must be provided in advance of service to the public, and it is only through financially strong investment companies with great credit standing that the necessary money can be obtained. Few appreciate that the electric light and power business, for instance, requires five dollars of capital for every dollar of income it receives; that this business alone required $1,300,000,000 of new money in 1924 to provide additional facilities for public service, and that today there is more than $6,500,000,000 invested in the business.

"The investment companies to a very large extent have been the cause of the great development in the production and distribution of electric energy in the United States during the past fourteen or fifteen years. Without them the developments that have taken place would have been practically impossible. Due to their high standing in the financial world, they have been enabled to secure money to finance projects which could not under any possible condition have been financed in the local way; and the financing of those projects has brought to the small towns and hamlets, and even to the rural districts now, a class of electrical service second only to that of the larger cities, and in some cases not even second. These results could not possibly have been secured had it not been for the massing of capital in these investment companies.

"The holding companies have grouped into large electrical districts numbers of small towns, supplied with energy from economic and efficient generating stations over well-built, high-class transmission systems, and provided for them a service the equal of which they could not have secured in any other way, and at rates very much lower than would be possible were it not for such grouping of these various properties.

Massed Capital

"Today the men in big business who use capital are not the owners of that capital, is another thought which should be imbedded in the public mind. It is the aggregate capital of a multitude of small capitalists who have invested their savings in that business. To secure that capital the investors, small and large, must have confidence in the business and its management."

"How can public confidence be secured?" Mr. Insull was asked.

"It has to be deserved by the management of the business and expressed by the public. The size of a business is no reason for its condemnation, and in most cases, if understood by the public, is good reason for its commendation provided the management, by its honesty, integrity, energy, candor and fair dealing with its employees and its customers shows that it is entitled to public confidence. The complexity of a great business is such as to make the uninformed, having no particular interest in it, suspicious, although through its greatness it may result in bringing to those who are suspicious the greatest net profit in happiness and mutual benefit.

A Reciprocal Confidence

"It is only through constant education of the citizenship by business men themselves that a full understanding of business as carried on today, and with it that necessary public confidence in business for the benefit of all the citizenship, can be brought about. Let us not be selfishly looking after only our own particular business interests in our communities but rather let us help the business prosperity, but at the same time we must not overlook the fact that our prosperity is dependent on the prosperity of the community as a whole. Never overlook that the manner in which we treat capital already invested in our midst largely determines whether or not we attract more capital to help in building up our communities and states."

Ninety-five Systems of More than 50,000 Kva. Generator Rating

A VERY clear and interesting picture of the national trend toward interconnection and the centralization of control in the electric light and power industry is to be found in the accompanying tabulation of central-station systems grouped in accordance with total rating of installed generators as of July 1, 1924. Comparing this tabulation with that to be found on page 810 of the October 20, 1923, issue of the ELECTRICAL WORLD, which table was as of October 1, 1922, it is found that during the two-year period the number of systems with a combined rating of more than 50,000 kva. had increased from eighty-one to ninety-five, and those with a combined rating of from 25,001 kva. to 50,000 kva. had increased from forty-four to sixty-eight. The number of systems with a combined rating of 25,000 and under decreased very materially, as indicated in Table I. The most noticeable and significant figure is the decrease in number of systems with a rating under 500 kva., which number decreased from 3,073 to 2,321 during the two-year period. This gradual elimination of the small plant has been reflected during the past three years in the large number of mergers and purchases which have been reported in the industry.

As the high-tension transmission lines are extended,

TABLE I—GROUPS OF SYSTEMS IN 1922 AND 1924

Size of Systems	July 1, 1924		October 1, 1922	
	Number of Systems	Total Generator Rating	Number of Systems	Total Generator Rating
Over 50,000 kva	95	15,208,165	81	11,142,159
From 25,001 to 50,000 kva	68	2,380,578	44	1,430,721
From 10,001 to 25,000 kva	119	1,907,022	127	2,001,591
From 2,501 to 10,000 kva	240	1,205,160	314	1,625,226
From 1,001 to 2,500 kva	297	483,487	410	672,740
From 501 to 1,000 kva	372	268,143	440	321,481
From 251 to 500 kva	564	207,002	707	260,361
From 101 to 250 kva	853	149,250	1,064	188,343
From 51 to 100 kva	521	40,858	664	52,308
Under 50 kva	383	12,859	638	20,554
All systems	3,512	21,862,524	4,489	17,715,484

making available the more reliable service of large generating plants, the existence of the small plants will become more and more limited. There are of course certain isolated communities in thinly populated sections which must depend upon the small local generating plant until the population grows and industry develops sufficiently to warrant the expense of constructing a long transmission line from a central point.

The ninety-five systems with a rating of more than 50,000 kva. reported a total generator rating of 15,208,165 kva., or 69.5 per cent of the total rating of the industry. In 1922 the systems in this class accounted for only 62.9 per cent of the industry, indicating the great strides made toward centralization of control. These large systems are most numerous in the East North Central States, where twenty-three were reported, followed by the Middle Atlantic States with twenty-one systems and the Pacific States with twelve systems rated above 50,000 kva. The Mountain States reported only three systems in this class.

There were 2,693 systems in the country with a rating under 1,000 kva. per system. This large number of systems, however, had an aggregate rating of only 678,112 kva., or 3.1 per cent of the total rating of the country. The greater number of these small systems was in the West North Central States.

TABLE II—CENTRAL-STATION SYSTEMS GROUPED IN ACCORDANCE WITH TOTAL RATING OF INSTALLED ELECTRIC GENERATORS—JULY 1, 1924

State	Systems Under 50 Kva.		Systems from 51 to 100 Kva.		Systems from 101 to 250 Kva.		Systems from 251 to 500 Kva.		Systems from 501 to 1,000 Kva.		Systems from 1,001 to 2,500 Kva.		Systems from 2,501 to 10,000 Kva.		Systems from 10,001 to 25,000 Kva.		Systems from 25,001 to 50,000 Kva.		Systems Over 50,000 Kva.	
	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.	No.	Total Kva.
United States	383	12,859	521	40,858	853	149,250	564	207,002	372	268,143	297	483,487	240	1,205,160	119	1,907,022	68	2,380,578	95	15,208,165
New England	7	274	11	824	16	2,590	35	13,369	28	21,462	23	38,703	28	124,623	16	252,396	9	308,449	10	1,119,956
Middle Atlantic	17	588	31	2,618	53	9,041	49	18,076	39	27,738	46	75,479	38	179,903	13	238,675	13	500,814	21	4,235,686
South Atlantic	32	1,136	62	4,922	105	18,915	67	24,803	47	36,181	26	39,722	35	177,103	20	326,505	7	236,332	11	1,919,028
East North Central	60	1,906	94	7,229	158	27,335	109	41,075	79	55,001	57	89,973	51	260,520	22	351,239	22	719,597	23	3,794,268
West North Central	126	4,223	146	11,214	242	41,984	122	41,999	74	51,592	55	87,274	33	173,434	17	258,132	4	138,925	7	675,602
East South Central	30	1,035	56	4,521	59	10,230	45	16,043	18	12,940	13	27,561	10	56,179	8	118,079	1	37,000	4	488,020
West South Central	72	2,421	71	5,561	140	24,995	90	33,440	45	31,773	31	49,562	22	110,370	11	175,162	4	152,437	4	371,750
Mountain	23	719	32	2,452	59	10,517	36	13,759	29	21,960	28	44,418	12	63,835	9	131,241	3	102,218	3	657,577
Pacific	16	557	18	1,517	21	3,643	11	4,438	13	9,496	18	30,795	11	59,193	3	55,593	5	184,806	12	1,946,278
New England																				
Maine	5	203	3	220	9	1,392	6	2,140	4	3,250	1	1,200	6	3,250	2	36,487			2	130,381
New Hampshire	1	50	4	310	2	352	11	4,358	4	2,775	6	11,735			2	26,500				
Vermont	1	21	3	237	2	450	7	2,829	8	5,941	6	10,025	3	18,030	3	36,749	1	40,750		
Massachusetts			1	57	1	147	9	3,249	7	5,621	4	5,233	15	82,944	7	109,160	4	109,887	6	785,575
Rhode Island					1	106							1	5,687			1	48,000	1	126,000
Connecticut					1	143	2	793	5	3,875	6	10,510	3	14,712	2	43,500	3	109,812	1	78,000
Middle Atlantic																				
New York	11	350	14	1,221	31	5,317	19	6,760	12	8,184	21	35,884	20	94,211	7	120,737	7	283,133	8	2,110,196
New Jersey	3	118	6	441	3	537	12	4,114	8	5,824	7	11,855	6	32,274			1	36,250	1	361,500
Pennsylvania	3	120	11	956	19	3,187	18	7,202	19	13,730	18	27,740	12	53,418	6	117,938	5	181,431	12	1,763,990
South Atlantic																				
Delaware					5	986			1	562			1	5,125			1	35,750		
Maryland	1	40	2	155	7	1,334	4	1,337	5	3,330	1	1,110	1	5,000	1	24,000	1	36,500	1	199,500
Dist. of Columbia																			1	98,000
Virginia	8	261	2	180	15	2,526	10	3,927	9	6,923	3	3,825	8	47,856	4	68,650			1	140,775
West Virginia	1	31	4	365	6	1,008	5	2,015	4	3,881	1	1,200	6	29,324	1	11,250	1	38,000	4	402,972
North Carolina	4	181	13	1,048	18	3,346	11	4,082	6	5,047	7	11,787	5	18,750	3	40,962	2	64,714	2	711,650
South Carolina	3	129	6	522	15	2,634	9	3,220	4	3,030	4	7,711	5	30,075	3	47,650	1	28,125	1	82,500
Georgia	7	206	28	2,187	29	5,244	21	7,727	7	5,683	3	3,615	3	16,460	5	88,768	1	33,243	1	283,631
Florida	8	288	7	465	10	1,837	7	2,495	11	7,725	7	10,474	6	24,513	3	45,225				
East North Central																				
Ohio	5	128	13	1,025	26	4,513	25	8,958	24	17,640	11	18,017	14	73,185	8	135,056	3	100,000	9	1,157,707
Indiana	7	214	10	712	17	3,185	14	5,165	14	9,777	12	17,043	8	39,037	4	77,335	7	224,042	3	227,375
Illinois	20	616	24	1,920	30	5,076	22	8,195	11	7,195	10	15,833	8	42,867	4	59,499	7	246,255	5	1,318,642
Michigan	10	350	20	1,575	45	8,050	22	8,089	15	10,106	13	20,910	12	55,545	1	10,200	1	36,500	3	710,299
Wisconsin	18	598	27	1,997	40	6,511	26	10,070	15	10,283	11	18,170	9	49,886	5	69,149	4	112,800	3	380,245
West North Central																				
Minnesota	10	398	12	999	39	6,840	14	4,758	12	8,383	7	10,539	7	28,614	3	38,198	1	36,250	1	77,960
Iowa	3	72	15	1,175	35	6,463	20	7,573	17	11,768	13	22,018	7	43,820	4	70,612	1	29,750	2	196,011
Missouri	25	789	18	1,366	38	6,822	18	6,213	10	7,208	8	10,505	6	30,787	4	57,728	1	30,750	3	335,381
North Dakota	47	1,552	26	1,850	20	3,037	7	2,043	4	2,982	4	5,437								
South Dakota	13	355	26	1,893	15	2,463	8	2,965	6	4,260	3	4,175	1	9,270	1	13,100				
Nebraska	18	633	29	2,338	51	8,515	26	8,607	6	4,777	9	14,344	5	23,938	2	23,937			1	66,250
Kansas	10	424	20	1,593	44	7,844	29	9,840	19	12,214	11	20,256	7	37,005	3	54,557	1	42,173		
East South Central																				
Kentucky	15	442	16	1,335	13	2,259	7	2,184	2	1,230	4	8,030	3	16,848	5	77,417			1	59,328
Tennessee	8	337	13	1,031	15	2,344	14	5,438	10	6,996	1	2,500	4	20,531	1	14,375	1	37,000	2	208,625
Alabama	2	61	8	713	9	1,436	9	3,015	2	1,440	4	7,956			1	11,050			1	220,020
Mississippi	5	195	19	1,442	22	4,191	15	5,406	4	3,274	4	9,075	3	18,800	1	15,237				
West South Central																				
Arkansas	12	449	13	937	19	3,820	11	4,079	7	4,399	3	4,868	5	27,258	2	33,362				
Louisiana	6	187	12	1,015	17	3,029	19	7,426	2	1,257	2	3,875	4	22,840					1	89,250
Oklahoma	11	381	11	834	35	6,506	23	8,066	13	8,284	7	11,681	6	29,098	3	38,150	2	58,156		
Texas	43	1,404	35	2,775	69	11,640	37	13,869	23	17,833	19	29,138	7	31,174	6	103,650	2	94,281	3	282,500
Mountain																				
Montana	9	272	8	541	9	1,569	8	3,154	4	2,874	3	4,581	1	3,000			1	30,000	1	423,815
Idaho	4	147	3	268	7	1,224	3	1,200	5	4,230	4	6,444			1	10,415			1	57,410
Wyoming	4	104	3	229	7	1,367	4	1,355	6	4,182	4	7,912	2	8,375	1	12,687				
Colorado	3	46	5	357	16	2,835	9	3,396	3	2,032	6	9,581	3	19,875	4	61,929	2	72,218		
New Mexico			3	248	8	1,349	6	2,228	1	990	4	5,675	1	7,400						
Arizona	2	100	3	230	2	362	3	1,139	4	3,350	2	2,850	4	20,685	2	35,460				
Utah	1	50	6	510	8	1,436	2	812	4	2,915	4	5,500	1	4,500					1	176,352
Nevada			1	75	2	375	1	475	2	1,387	1	1,875			1	10,750				
Pacific																				
Washington	8	313	10	846	5	886	2	945	4	3,218	8	14,637	5	29,824	1	20,000			3	395,087
Oregon	5	118	5	436	12	2,020	5	1,856	5	3,253	3	4,723	2	8,442			2	76,806	1	110,856
California	3	126	3	235	4	737	4	1,637	4	3,025	7	11,435	4	20,927	2	35,593	3	108,000	8	1,440,335

Unbiased Comparison of Ice-Plant Drives

Individual Power Plants Have Economic Place in Some Cases, but Progressive Central-Station Companies Are Offering Rates that Make Such Plants Economically Prohibitive

By an ICE MACHINE MANUFACTURER

EXCEPT where the raw water directly available is strictly unsuitable for making clear commercial ice, few ice manufacturers think any more in terms of the distilled-water product. Where the condition stated exists the plain distilled-water plant is the only system to which to resort; but since the raw-water plant unquestionably predominates today, this process should be of great interest to any one now in the ice business or who contemplates entering the business.

Any one who has thoroughly investigated the subject of prime movers for modern ice plants and whose opinion is unbiased must have concluded that the motor-driven plant is the desirable one provided power supply is reliable. That type of plant requires the least amount of building space and the least amount of skilled labor. It must of necessity have a lower maintenance cost and the machinery takes a lower depreciation rate. This opinion is not intended to exclude the possibility of good talking points in favor of steam-driven or oil-engine-driven plants. The choice of the prime mover will have to depend on the over-all operating expense, the reliability of service and the relative convenience and flexibility of operation. The fact cannot be overlooked, however, that in all the largest cities and centers electrical energy is being developed for industrial and manufacturing purposes and being sold at a price which virtually prohibits the economical installation of individual power plants in various industries and manufacturing plants.

WHAT HAS BEEN DONE IN SOME CITIES

Consider the cities of New York, Chicago, Cleveland, Detroit, Philadelphia, St. Louis and San Francisco. In these cities the motor-driven ice plant prevails and is the outstanding plant today. This condition exists despite the fact that not many years ago, even since the development of an efficient raw-water system, one ice plant was established in New York City in which the compressors were driven by uniflow engines and auxiliary power supplied from a uniflow-engine-driven electric unit which made an average of 18 tons of ice per ton of coal, operating on steam at 155 lb. pressure, 150 deg. superheat, and condensing at 25 in. to 26 in. vacuum. Water supply was obtained from deep wells

Comparison of Over-All Manufacturing Cost

100-TON HIGH-PRESSURE RAW-WATER PLANT, 1,600 300-LB. CANS, 35,000 FT. 1¼-IN. PIPE, FOUR-CAN

ELECTRIC PLANT

Two compressor units, synchronous-motor-driven

Ice-making machinery an i water system f.o.b. factory	$79,000	
Freight, erection, ammonia, electric wiring and miscellaneous	15,000	
Synchronous motors and switchboard, erected	12,000	
		$106,000
Buildings, insulation, etc.; engine room, tank room, daily ice storage and office, at $0.11½ per cubic foot	$34,000	
Insulation of ice tank, daily storage, etc.	10,500	
10,000-ton season ice storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000	
		$142,500
Total investment, exclusive of land		$248,500

Operating Cost per Year

Labor:		
One chief engineer, at $225 per month	$2,700	
Two watch engineers, at $175 per month	4,200	
Three ice pullers, at $30 per week	4,680	
Power:		
Yearly average, 46 kw.-hr. per ton, including storage, 32,000 tons, at 1.5 cents per kilowatt-hour, average	22,100	
Oil, waste, ammonia and miscellaneous, at $0.07 per ton	2,240	
Water for ice-making and tower make-up, 500 gal. per ton, at $0.10 per 1,000 gal.	1,600	
Maintenance on machinery, at 2 per cent on $106,000	2,120	
		$39,640
Fixed Charges:		
Interest, at 6 per cent on $248,500	$14,910	
Depreciation on buildings, 3½ per cent on $142,500	5,000	
Depreciation on machinery, 6 per cent on $106,000	6,360	
Insurance, taxes and miscellaneous, 1½ per cent on $248,500	3,720	
		29,990
Total operating cost		$69,630

$$\frac{\$69,630.00}{32,000\ (\text{tons})} = \$2.17 \text{ per ton}$$

UNIFLOW ENGINE-DRIVEN PLANT

Two compressor units, uniflow-engine-driven generator for auxiliaries

Ice-making machinery and water system, with steam condenser and auxiliaries, f.o.b. factory	$98,000	
Freight and erection, ammonia, salt, electric wiring, steam and exhaust mains (covered)	19,100	
Two 200-hp. boilers, water tube, 165 lb. steam, 150 deg. superheat, with superheaters, economizers, stack, brickwork and boiler-feed pump, erected	22,000	
100-kva. generator connected to uniflow engine	7,800	
		$146,900
Buildings, insulation, etc.; engine room, tank room, daily ice storage, boiler room and office, at $0.11½ per cubic foot	$36,500	
Insulation of tank, daily ice storage, etc.	10,500	
10,000-ton season storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000	
		$145,000
Total investment, exclusive of land		$291,900

Operating Cost per Year

Labor:		
One chief engineer, at $275 per month	$3,300	
Two watch engineers, at $175 per month	4,200	
Three ice pullers, at $30 per week	4,680	
Three firemen, at $36 per week	5,616	
Fuel:		
Average 2.8 i.-hp. per ton ice, including storage, at 14.5 lb. steam per i.-hp.-hr. equals about 15½ tons ice per ton coal (32,000 ÷ 15½) = 2,060		
Tons coal, at $4.50	9,300	
Oil, waste, ammonia, supplies, etc., at $0.09 per ton	2,880	
Water for ice-making purposes and boiler and cooling tower make-up, 600 gal. per ton, at $0.10 per 1,000 gal.	1,920	
Maintenance on machinery, at 3 per cent on $146,900	4,407	
		$36,213
Fixed charges:		
Interest at 6 per cent on $291,900	$17,514	
Depreciation on buildings, 3½ per cent on $145,000	5,075	
Depreciation on machinery, 8 per cent on $146,900	11,752	
Insurance, taxes, and miscellaneous, 1½ per cent on $291,900	4,378	
		38,719
Total operating cost		$74,932

$$\frac{\$74,932.00}{32,000\ (\text{tons})} = \$2.34 \text{ per ton}$$

(Equivalent to electric power at 1.86 cents per kilowatt-hour)

at about 55 deg. If the bare cost of fuel of this steam-driven plant were compared with the cost of power in New York at 1 cent per kilowatt-hour, it would appear that the steam plant should have held its own. However, that is the mistake so generally made in considering the building of a plant. The buyer is prone to make comparisons strictly on a fuel versus power basis. It is hoped the following will bring out the fallacy of this.

In new communities or less concentrated communities there will always be reason for the selection of prime movers other than electric motors until the power systems serving them become modernized and the cost of electric power is reduced to enable it to compete with the over-all cost of operating individual plants. However, the time is almost bound to come when nearly every ice plant will be motor-driven.

In Oklahoma or Texas, for example, where fuel oil is cheapest, there appears to be no reason why power should not be generated in large oil-engine-driven stations or in steam-turbine plants using oil-burning boilers and sold to consumers at a price which would make separate installations of oil engines in ice plants economically prohibitive. If the economic superiority of central-station power over individual ice-plant power stations has been proved in New York with coal, it certainly will be proved sooner or later in Oklahoma or Texas with oil, and similarly in any locality. The central power station is the coming thing and the motor-driven ice plant is coming along with it.

Let it be understood that the foregoing statement is not intended to boost the motor game unfairly, but to point out the possibilities and to suggest what is actually happening in localities where industries, and therefore power plants, are becoming modernized.

Reverting to the subject of electric power and fuel costs and their relation to the over-all costs of ice manufacturing—namely, operating cost plus fixed charges—to clear up any misunderstanding which exists regarding these relations a typical ice plant will be considered and the cost of operation analyzed with various types of prime movers. A 100-ton modern raw-water ice plant is assumed using a cooling-water tower, sixteen 300-lb. ice cans in two tanks, about 35,000 ft. of 1¼-in. pipe with all modern appurtenances for multiple-can harvesting and automatic can filling at the dump, operating over a period of eleven months on a 10,000-ton season storage with a year's production of 32,000 tons of ice. Four types of prime movers will be considered:

1. Motor-driven plant using two ammonia compressor units, synchronous motor-driven, direct-connected; all motor-driven auxiliaries.

2. Uniflow engine-driven plant using two compressor units, each direct-connected to uniflow engine, and a uniflow engine-driven generator of sufficient size for driving all auxiliaries by motor; water-tube boilers, 165 lb. steam pressure, 150 deg. superheat, with modern superheaters, economizers, motor-driven boiler-feed pumps and so forth; engines operating condensing.

3. Oil-engine-driven plant using two ammonia compressor units, each belted to full-Diesel type oil engines, and one oil-engine-driven generator set of sufficient size for driving all auxiliaries by motors.

6. Oil-engine-driven plant using less expensive oil engines of the semi-Diesel type, using two compressor units, each belted to oil engine, and one oil-engine-driven generator set of sufficient size to drive all auxiliaries by motor.

of Making Ice With Different Prime Movers*

LIFT, AUTOMATIC FILL AND 10,000-TON SEASON ICE STORAGE; PRODUCTION, 32,000 TONS PER YEAR

OIL-ENGINE-DRIVEN PLANT

Full-Diesel type (Busch-Sulzer type or equal), two compressor units, one generator unit

ce-making machinery and water system, f.o.b. factory	$78,000	
Freight, erection, ammonia, salt, wiring, etc.	14,000	
Two oil-engine units for driving ammonia compressors by belts, erected, including oil piping, tanks, etc.	35,000	
100-kva. generator, direct-connected to 150-hp. oil engine	20,000	
		$147,000
Buildings, insulation, etc.; engine room, ice-tank room, daily ice storage and office, at $0.11½ per cubic foot	$37,000	
Insulation of ice tank, daily storage, etc.	10,500	
10,000-ton season ice storage, including insulation, elavator, doors, etc., at $9.80 per ton, complete	98,000	
		145,500
Total investment, exclusive of land		$292,500

Operating Cost per Year

Labor:		
One chief engineer, at $275 per month	$3,300	
Two watch engineers, at $175 per month	4,200	
Two extra men, at $36 per week	3,744	
Three ice pullers, at $30 per week	4,680	
Fuel:		
Average 2.6 eng. h.-hp. per ton, including storage, 5½ gal. fuel per ton ice, at $0.05 per gallon	8,800	
Engine lubricating oil, 1 gal. per 1,000 hp. equals 0.07 gal. per ton ice, at $0.50 per gallon	1,120	
Compressor oil, waste, ammonia, etc., at $0.07 per ton	2,240	
Water for ice-making and cooling tower make-up, 500 gal. per ton, at $0.10 per 1,000 gal.	1,600	
Maintenance on machinery, at 4 per cent on $147,000	5,880	
		$35,564
Fixed charges.		
Interest at 6 per cent on $292,500	$17,550	
Depreciation on buildings, 3½ per cent on $145,500	5,100	
Depreciation on machinery, 8 per cent on $147,000	11,760	
Insurance, taxes and miscellaneous, 1½ per cent on $292,500	4,388	
		38,798
Total operating cost		$74,362

$$\frac{\$74,362.00}{32,000 \text{ (tons)}} = \$2.32 \text{ per ton}$$

(Equivalent to electric power at 1.83 cents per kilowatt-hour)

OIL-ENGINE-DRIVEN PLANT

Semi-Diesel type (Fairbanks-Morse, Worthington or equal), two compressor units, one generator unit

Ice-making machinery and water system, f.o.b. factory	$75,000	
Freight, erection, ammonia, salt, wiring, etc.	14,000	
Two oil-engine units for driving ammonia compressors by belts, erected, including oil piping tanks, etc.	19,000	
100-kva. generator, direct-connected to 150-hp. oil engine	12,500	
		$123,500
Buildings, insulation, etc.: engine room, ice-tank room, daily ice storage and office, at $0.11½ per cubic foot	$37,000	
Insulation of ice tank, daily storage, etc.	10,500	
10,000-ton season ice storage, including insulation, elevator, doors, etc., at $9.80 per ton, complete	98,000	
		145,500
Total investment, exclusive of land		$269,000

Operating Cost per Year

Labor:		
One chief engineer, at $275 per month	$3,300	
Two watch engineers, at $175 per month	4,200	
Two extra men at $36 per week	3,744	
Three ice pullers, at $30 per week	4,680	
Fuel:		
Average 2.6 eng. b.-hp. per ton, including storage, 7 gal. fuel oil per ton ice, at $0.07 per gallon	1,160	
Engine lubrucating oil, 1 qt. per 100 hp.-hr. equals 0.175 gal. per ton ice, at $0.50 per gallon	2,800	
Compressor oil, waste, ammonia, etc., at $0.07 per ton	2,240	
Water for ice-making and cooling tower make-up, 500 gal. per ton, at $0.10 per 1,000 gal.	1,600	
Maintenance on machinery, at 5 per cent on $123,500	6,175	
		$39,899
Fixed charges:		
Interest, at 6 per cent on $269,000	$16,140	
Depreciation on buildings, 3½ per cent on $145,500	5,100	
Depreciation on machinery, 9 per cent on $123,500	11,115	
Insurance, taxes and miscellaneous, 1½ per cent on $269,000	4,040	
		36,395
Total operating cost		$76,294

$$\frac{\$76,294.00}{32,000 \text{ (tons)}} = \$2.38 \text{ per ton}$$

(Equivalent to electric power at 1.96 cents per kilowatt-hour)

*No storage labor included.

In each case it will be noted that two ammonia compressor units have been selected. This is done, first of all, to obtain a better load factor and, second, to reduce the hazard of service interruption. It would hardly be fair to make comparisons based on two units in one case and a larger unit in another case. There are many other advantages to substantiate the selection of two large compressors each individually driven rather than a large single unit. The two compressors need not necessarily be of equal size, but nevertheless there should be two.

Power and fuel costs are based on the following estimate: Electric energy at 1.5 cents per kilowatt-hour (average for the year), taking into consideration load factor, maximum-demand charge and so forth; coal at $4.50 per ton delivered to the boiler room in bunkers or otherwise; fuel oil at 5 cents per gallon for oil-engine-driven purposes, delivered and placed in tanks at plant.

It is not assumed that these three unit costs of power and fuel will exist at any one point in the country. It is realized that at some places the cost of coal is virtually prohibitive while in the same places fuel oil may be very cheap. The same thing might apply to electric power in certain localities as compared with raw-fuel costs. However, there are localities where this particular combination does exist, and such places represent the average between oil fields and coal fields. Substitution of other unit prices can be readily made in the analysis shown in the accompanying tabulation for any fuel or power costs.

By referring to the accompanying tabulation it will be noticed that the total manufacturing cost per ton of ice, including operating costs and fixed charges, is as follows: Motor-driven plant, $2.17 per ton; uniflow steam-engine-driven plant $2.34 per ton; full-Diesel oil-engine-driven plant, $2 32 per ton; semi-Diesel oil-engine-driven plant, $2.38 per ton.

Between the last two plants it will be noted that there is an increase of 6 cents per ton from using the cheaper engine. That difference is accounted for by higher fuel-oil consumption, and particularly by higher lubricating oil cost and maintenance cost. The full-Diesel type engine has a much more scientific and efficient lubricating system, everything being force-feed, eliminating splash with consequent vaporization. Furthermore, the full-Diesel type engine works under higher pressure and temperatures and is designed and built to operate more economically on fuel oil.

The interesting feature of this tabulation is the relation between the fuel or power cost per year and the total manufacturing cost. As mentioned before, fuel costs are often compared without due consideration to much else that enters into the cost of ice, and the accompanying tabulation will indicate why in many instances purchasers are misled.

RELATION BETWEEN FUEL OR POWER COST AND TOTAL MANUFACTURING COST

Type of Plant	Total Yearly Manufacturing Cost	Yearly Power or Fuel Cost	Ratio of Power or Fuel Expense to Total Manufacturing Cost Per Cent
Motor-driven	$69,630	$22,100	32.0
Uniflow steam-engine-driven	74,932	9,300	12.5
Full-Diesel oil-engine-driven	74,362	8,800	11.9
Semi-Diesel oil-engine-driven	76,294	11,160	14.7

In the foregoing tabulation it will be noted that the motor-driven plant pays 32 per cent of its total manufacturing cost in power bills and still makes ice for the least money. First of all, the total investment in the plant is lower, which cuts down the fixed charges. Second, the labor requirement in this plant is less by reason of its simplicity. Third, the upkeep or maintenance cost is bound to be less. In this discussion there is not enough space to prove the latter statement, but a careful and conscientious investigation of plants operated by motors and other prime movers will prove that the maintenance cost of the motor-driven plant is least. Fourth, the type of engineering skill is not required in a motor-driven plant that is, of necessity, needed in a steam or oil-engine-driven plant.

FIXED CHARGES MUST BE CONSIDERED

The fixed charges of the four equivalent plants considered represent the greatest differences between the over-all operating expenses of these plants and are the charges that are often overlooked or often underestimated. In the case of the uniflow engine-driven plant and oil-engine-driven plant the fuel cost runs from 11.9 per cent to 14.7 per cent of the manufacturing cost, which shows that the power cost in the motor plant is virtually two and one-half times the average cost obtained by the use of coal or fuel oil, but in the steam plant and oil engine-driven plants the investment makes the fixed charges soar and the maintenance is bound to be higher. More and better skilled labor is required. Besides, there is the increased hazard of interruption of service with these prime movers, particularly the oil-engine-driven plants—a story which cannot be written into these tabulations. This statement is not intended to be detrimental to the oil-engine builder, but it remains a fact that high-speed reciprocating units working under high temperatures and at a continuous full load are subject to occasional breakdowns, much more so than a motor. It does not take a very long shutdown in a 100-ton ice plant seriously to curtail the earnings and cause a loss which would probably offset any gain that the owner hoped to secure by the selection of a particular prime mover.

Below the column in the tabulation referring to the steam-engine-driven and oil-engine-driven plants figures will be noted indicating how much could be paid for electric power in each case to bring the cost per ton of ice in the motor-driven plant on a level with that shown in any other type. In other words, with the steam-engine-driven plant, which makes ice cost $2.34 per ton, electricity could be purchased at an equivalent overall expense for 1.86 cents per kilowatt-hour; in the full-Diesel oil-engine plant, where ice costs $2.32 per ton, 1.83 cents per kilowatt-hour could be spent for power. This figure does not take into account the monetary expense of an interruption in service.

SOMETHING TO THINK ABOUT

In view of these figures or any others which may be arrived at in an equally fair analysis of the situation, why should not an ice manufacturer be willing to pay a rate for electric power which might make the ice cost a little more than what appears to be possible by the use of any other prime mover? That is something that any user of power should stop and think about. A motor is the only prime mover that really produces a constant efficiency with a minimum amount of attention. A uniflow engine-driven or oil-engine-driven plant must be kept in top-notch condition if it is to produce maximum capacities at maximum economy throughout a period of eleven months.

Measuring Effects of Corona on Rubber

Deleterious Effects Are Produced by Ozone in a Very Short Time if the Rubber Is Subjected to Corona and Tension Simultaneously—Significance in Testing Linemen's Rubber Goods

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TESTS have been conducted that emphasize the importance of the proper use of rubber whenever it is to be subjected to high voltages. Rubber should never be placed under tension where there is any possibility of corona playing upon it, even for short periods of time. Deleterious effects are produced in a matter of seconds, whereas the ordinary aging of rubber takes days to show an effect. Therefore it is important from the viewpoint of life or death of linemen that the foregoing be deeply borne in mind whenever the various types of linemen's rubber safeguards and appliances are tested and used. Furthermore, it applies to applications of rubber insulation that may be normally or at times under tension in the presence of corona.

While testing a piece of soft vulcanized rubber a few years ago by means of the apparatus shown in Fig. 1 the author discovered that the rubber was very noticeably cracked at the edges of the electrodes. The electrodes were 1-in. brass squares, the edges of which were rounded to $\frac{1}{16}$ in. radius. Pressure was exerted on the rubber by a hand screw sufficient to insure good contact. The top of the lower electrode was about 1 in. above the hard-rubber base, thereby permitting the rubber to bend down somewhat as shown and produce slight tension on the upper surface just outside the edges of the electrodes; the bottom surface of the rubber was slightly compressed when voltage (sixty-cycle) was increased. However, when the voltage was still further increased, there was no cracking produced on the under (compression) side of the rubber.

Degree of Cracking Depends Upon Length of Time Voltage Is Applied

Upon discovering the cracking on the surface of the rubber where there was slight tension, a series of tests was made with the same apparatus, using various voltages and exposures of various lengths of time. The results of these tests are shown in Figs. 3 and 4. In Fig. 3 the effects of various rates of increase of voltage are reproduced. It is very apparent that the degree of cracking depends on the time element. Contrast the cracking in Test 1, where the total time of exposure was 390 seconds, to that in Test 8, where the total time of exposure was twenty-five seconds. In Fig. 4 specified voltages were held constant until breakdown occurred. Again the time element was important. In Test 10, where there was no cracking whatever, the rubber was subjected to 10,000 volts for ten minutes. The condition of combined voltage and tension apparently was below the critical stage. In all of these tests there was no cracking in evidence on the bottom side of the rubber.

Sheets of soft vulcanized rubber were later tested under tension by means of a different type of apparatus whereby the load was applied by dead weights (see Fig. 2). A $\frac{1}{4}$-in. diameter steel rod was laid on a $\frac{1}{32}$-in. sheet of the rubber stretched by a specified load. Fig. 5

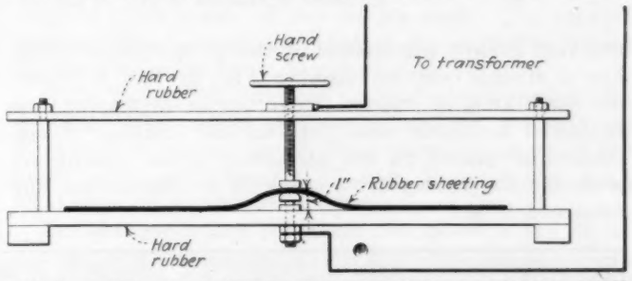


FIG. 1—SOFT VULCANIZED RUBBER SUBJECTED TO CORONA WITH UPPER SURFACE SLIGHTLY IN TENSION WAS NOTICEABLY CRACKED

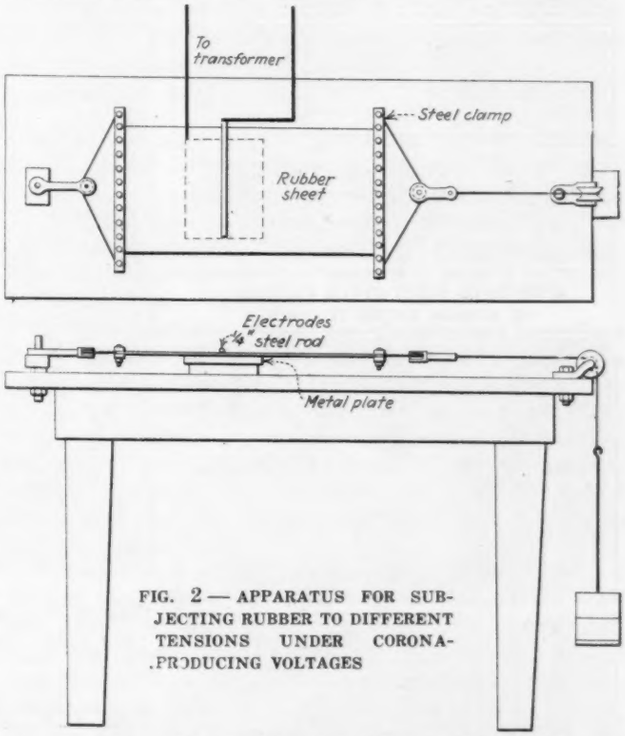
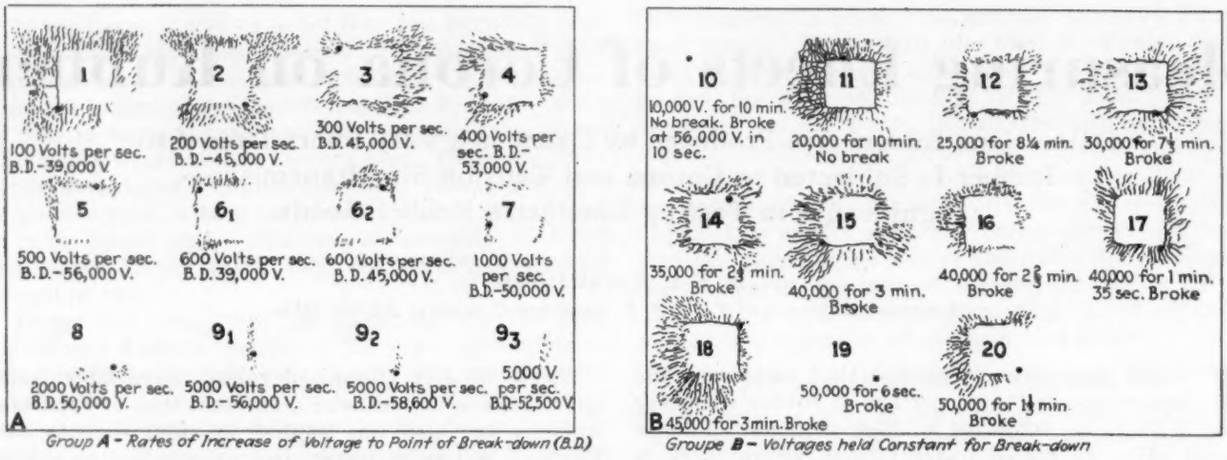


FIG. 2 — APPARATUS FOR SUBJECTING RUBBER TO DIFFERENT TENSIONS UNDER CORONA-PRODUCING VOLTAGES

shows the results of this test. It may be plainly observed that the cracking of the stretched rubber was progressive with the voltage. Fig. 6 shows the effect of sharp edges on the degree of cracking of soft vulcanized rubber. It also shows that with an air gap beneath the top electrode the cracking was considerably diminished. In Test *E* of Fig. 6 a piece of light fabric was placed on the stretched rubber and a $\frac{1}{4}$-in. steel rod electrode placed on this. The cracking

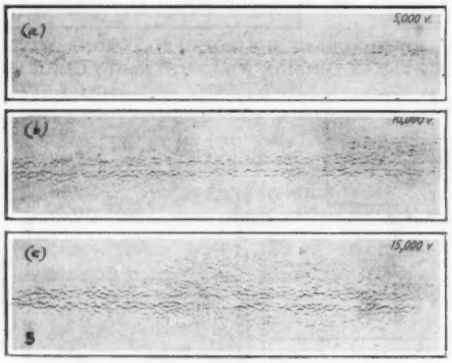


Group A - Rates of Increase of Voltage to Point of Break-down (B.D.) *Groupe B - Voltages held Constant for Break-down*

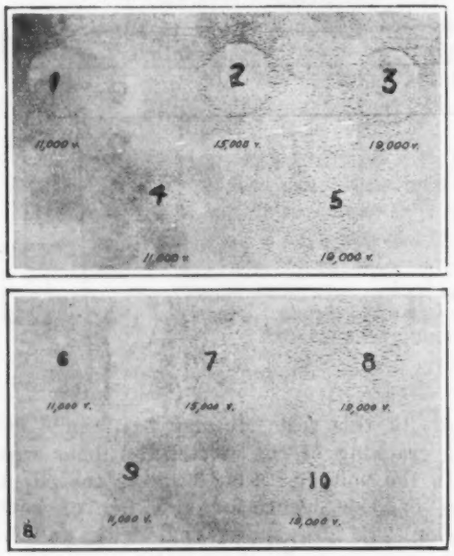
FIGS. 3 AND 4—EFFECTS ON RUBBER UNDER TENSION OF VOLTAGES APPLIED UP TO BREAKDOWN
A—Effect of changes in rate of voltage increase. *B*—Effect of constant voltages.

was very greatly diminished by this protective covering. For a strong contrast observe Fig. 5, Test *c*, where the same kind of rubber under the same tension was subjected to 15,000 volts for but one minute. A cellulose film placed on the stretched rubber completely protected the rubber from cracking as long as the film remained intact.

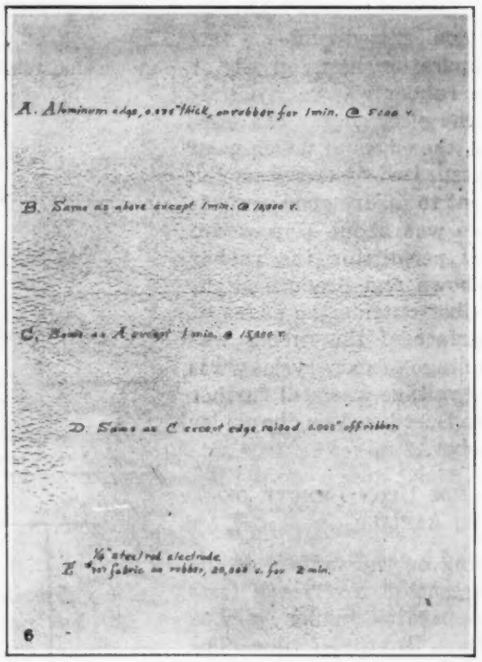
The result of an effort to indicate more clearly the relationship between tension in the rubber and the degree of cracking is shown in Fig. 7. It may be seen that the cracking is more severe at a tension of 40 lb. per square inch than at 20 lb. per square inch. Apparently a maximum effect is reached, then falls off decidedly as the tension is increased. This may be



EFFECTS OF SIXTY-CYCLE VOLTAGE ON RUBBER UNDER TENSION



EFFECT OF SHAPE OF ELECTRODE ON CRACKING OF SOFT VULCANIZED RUBBER UNDER TENSION AND CORONA. DISK AND SPHERE ELECTRODES WERE USED

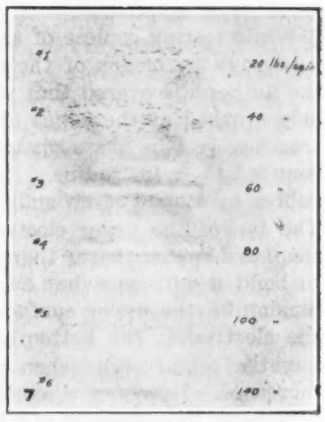

A. Aluminum edge, 0.032" thick, on rubber for 1 min. @ 5000 v.
B. Same as above except 1 min. @ 14,000 v.
C. Same as A except 1 min. @ 15,000 v.
D. Same as C except edge raised 0.005" off rubber
E ⅛" steel rod electrode. Cotton fabric on rubber, 20,000 v. for 2 min.
6

EFFECTS OF SIXTY-CYCLE VOLTAGE ON RUBBER

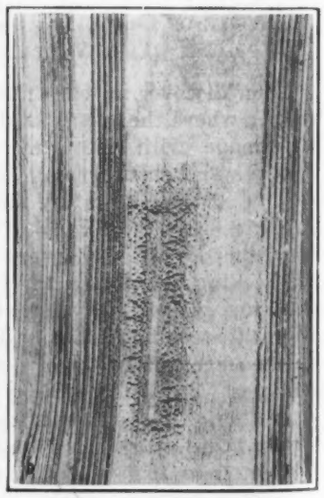
Fig. 5 (A)—¾-in. rod on rubber sheet; elongation of rubber 10 per cent; time one minute; tension 30 lb.

Fig. 6 (B)—Rubber sheets 7.5 in. wide; 0.09 in. thick, tension 30 lb., elongation 10 per cent.

Fig. 7—Relation between tension and cracking of rubber under corona subjected to 12,000 volts for two minutes, at various tensions; ⅜-in. rod; sixty-cycle voltage. Fig. 8—Two types of electrodes were used. (1) 1-in. brass disk with edges rounded to ¼ in. radius; (2) 1-in. brass sphere with flat plate on bottom. In tests 1, 2 and 3 the round circular electrode was in contact with rubber; in tests 4 and 5 it was 1/64 in. above rubber. In tests 6, 7 and 8 the sphere was in contact with rubber; in tests 9 and 10 it was 1/64 in. above rubber. In all cases the tension on rubber was 35 lb.; sixty-cycle voltage was applied for one minute. Fig. 9—*Hevea brasiliensis* (crude rubber) stretched 10 per cent was subjected to 18,000 volts from ⅜-in. diameter steel rod for two minutes.



EFFECT OF TIME OF APPLICATION OF VOLTAGE TO RUBBER



CRUDE RUBBER CRACKS UNDER TENSION AND CORONA MORE SERIOUSLY THAN SOFT VULCANIZED RUBBER

due to the increase in hardness of the surface of the rubber as the tension is increased.

The effects of the shape of the electrode by which a piece of stretched soft vulcanized rubber is tested are shown in Fig. 8. The electrode used on the upper portion was a 1-in. brass sphere. These illustrations show in some measure the difference in the strength of the field around the two types of electrodes.

Crude rubber cracks even more seriously than soft vulcanized rubbers when stretched and subjected to corona. Fig. 9 shows a sample of *Hevea brasiliensis* as it came from the importer, after being subjected to 18,600 volts for two minutes under a given tension.

UNSTRETCHED RUBBER IS LITTLE AFFECTED BY CORONA

A sheet of plain soft vulcanized rubber (not stretched) was subjected at close range to a potential of 25,000 volts for forty-five minutes by a plate electrode ⅛ in. above the rubber. The corona formed over the surface of the rubber was very noticeable. At the end of the test period standard dumbbell tensile test pieces were cut from the portion of the rubber that had been subjected to the corona. Tensile test pieces were also cut from a portion of the rubber that had not been subjected to the corona. A tensile test on three unstretched samples indicated that there was no deterioration of the rubber whatever from being subjected to the corona. This indicates that unstretched rubber is not affected by the corona, at least over a period of many minutes.

The cracking of soft vulcanized and crude rubbers, when stretched, in contact with or near an electrode that is emanating corona is a phenomenon having two possible explanations. One who is well versed in the hypothesis of Townsend, who formulated and verified the theory of ionization by collision, would immediately suppose that the rapid bombardment of gas ions which produces the corona produces a cutting action on the stretched rubber, for rubber cuts much more readily when stretched than when unstretched or when compressed. The other explanation of this phenomenon is that the ozone generated by the formation of corona is the destructive agent. This was definitely proved, and yet does not disprove the other theory. A small ozonizer was made of a small glass tube passing through a larger one with corks at its ends. One electrode was placed in the small tube and another on the outside of the large tube. Oxygen was passed through the ozonizer, to which 17,000 volts were applied. The ozonized oxygen on leaving the ozonizer was passed into a glass dessicator, where samples of stretched rubber were placed.

OZONE APPEARS TO BE THE DESTRUCTIVE AGENT

The concentration of the ozone in the dessicator was chemically determined as one-half of 1 per cent. In this atmosphere a test strip 5 in. long bent back on itself broke completely in two after 1¾ minutes. The same relation between tension of the rubber and degree of cracking was obtained as before. The cracking reached a maximum when 5-in. test strips were stretched to 10 per cent of their original length. The cracking then decreased very markedly as the elongation increased.

A proper understanding of these test results should greatly increase the safety of the use of rubber for protective purposes in the electrical industry.

Letters from Our Readers

Ocean Cable Transmission

To the Editor of the ELECTRICAL WORLD:

In an article on page 1255, issue of June 13, 1925, on "Ocean Cable Transmission Studied in a Laboratory," the time given for impulse passing through this cable must refer to a "laboratory cable," because those in commercial use have to work at a much greater speed.

The "Continental Morse" code is used and contains two letters of one impulse, four of two, eight of three and twelve of four impulses. In an old handbook published in 1884 the following by Dr. Alexander Muirhead appears: "Speed of Jay Gould Cables, March 29, 1883. A thousand code words were sent from Penzance to Canso in eighty-one minutes, including all repetitions and collations. They contained 7,288 letters, equivalent to 1,458 words of five letters each. The rate of transmission is therefore eighteen words of five letters per minute, ordinary or 'simplex' working."

With "duplex" the rate of transmission is practically doubled. Dimensions of above cable. No. 2, Penzance, Cornwall, to Cape Canso, Nova Scotia; length 2,518 knots, total resistance at 75 deg. F. = 8,320 ohms, total capacity = 939 microfarads.

Dr. Muirhead does not mean the speed in one direction doubled when working "duplex," but that the "business" can be doubled because it can be handled simultaneously in two directions. Cables must have improved since this time and the present-day cable should have better signal transmitting qualities than one manufactured around 1880-1881.

Vancouver, B. C. L. E. DUNHAM.

More Thoughts on Refrigeration Merchandising

To the Editor of the ELECTRICAL WORLD:

I have just read in the ELECTRICAL WORLD for July 18 the article "Should Central Stations Merchandise Electric Refrigeration," by Winston Paul. I wish to approve this article and believe your paper has done a constructive piece of work by publishing it.

In Pittsburgh the dealers and distributors have been going through all of the missionary work in connection with the use of electric refrigeration in the home for several years, and some of the distributors and dealers have lost considerable money in taking on and pushing the sale of machines which afterward proved unsatisfactory, although these machines were manufactured and sold by some of the strongest manufacturers financially in the country.

Taking it as a whole, however, these distributors and dealers have gradually worked up a demand for electric refrigeration and we feel that they should now reap the benefit from profits on sales being made at this time, rather than have the central-station merchandising stores now step into the field and by giving special long-time payment privileges, etc., secure the orders for machines of the different makes.

On account of this situation, we feel that the central stations can now help by distributing advertising matter and recommending electric refrigeration, in this way stimulating further the demand. By so doing they will help the distributors and dealers who have for several years spent considerable money and effort in getting the situation where it is today. C. W. RIDINGER,

Pittsburgh, Pa. President Iron City Electric Company.

Central Station and Industrial Practice

Rewinding Regulators to Change Phase

TWENTY-ONE two-phase Westinghouse feeder regulators owned by the United Electric Light & Power Company, New York, were recently rewound and reconnected for three-phase operation. This apparatus was formerly rated at 2,100 volts, 202 secondary amp., with 10 per cent buck and boost. The

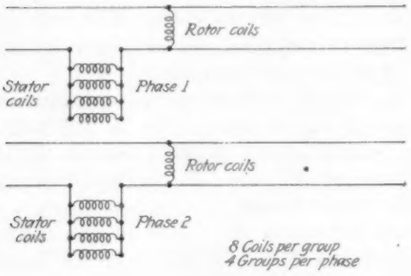


FIG. 1—SCHEME OF TWO-PHASE REGULATOR CONNECTIONS

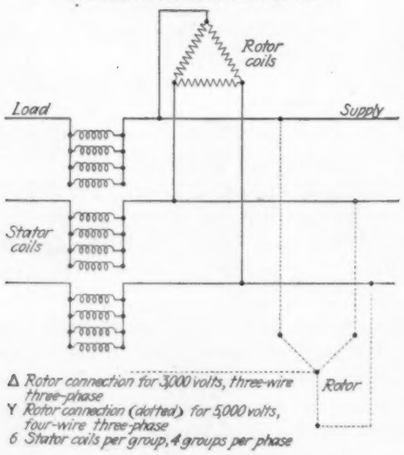

Rotor coils
Load
Supply
Stator coils
Δ Rotor connection for 3,000 volts, three-wire three-phase
Y Rotor connection (dotted) for 5,000 volts, four-wire three-phase
6 Stator coils per group, 4 groups per phase
Rotor

FIG. 2—SCHEME OF THREE-PHASE REGULATOR CONNECTIONS

regulators will be temporarily operated on a 3,000-volt, three-phase, three-wire circuit, with 8.7 per cent buck and boost, later being reconnected for 5,200-volt, three-phase, four-wire service, with 5 per cent buck and boost and a secondary rating of 200 amp.

The rotors of these regulators are designed with sixty-four slots and were formerly wound with eight groups of coils and eight coils per group. Each coil consisted of ten turns of 0.144-in. square wire, the throw being one to thirteen, groups all in series, four-pole, two-phase. In rewinding, the same pitch was used, each coil consisting of twenty turns of 0.072-in. square wire instead of ten, wound in parallel, connecting in series delta for 3,000 volts and in series Y for 5,200, three-phase, four-wire service.

The stators were not rewound. Each has eighty slots, eight groups of coils wound ten coils per group, each coil having four turns of two 0.129-in. square copper wires in parallel. The throw is one to fifteen, four groups of coils being in parallel per phase. Rewinding the stators would have increased the cost unduly, and in reconnecting it was necessary to make but eight coils dead per regulator, open-circuiting these to prevent burnouts. The scheme of connections is illustrated herewith.

The regulator operating motor was rewound for 220-volt, three-phase, three-wire supply. All rotors and stators are obliged to withstand a potential test of 12,000 volts between phases and 7,000 volts between coils and ground for one minute with the rotor in place. The work on these regulators was done by the American Electric Service & Maintenance Company, Springfield, Mass.

Transformer Tap Changing Under Load

Description of Method Used by Commonwealth Edison Company of Chicago to Regulate Voltage of the Transformers on 33,000-Volt Station Tie Lines

BY FRANK V. SMITH
General Engineering Department, Westinghouse Electric & Manufacturing Company

ON THE SYSTEM of the Commonwealth Edison Company in Chicago there have recently been installed four 15,000-kva. transformers with tap-changing equipment for varying the voltage under load, and a fifth is now on order. The scheme utilized to secure this variable ratio has a number of points in principle of operation and construction of the apparatus which should be of interest to operating engineers.

At each station of the company are a number of transformer banks stepping the sixty-cycle power up from 12,000 volts to 33,000 volts, and it is at this voltage that tie lines are run between the various stations by means of three conductor cables. Each transformer bank is rated at 15,000 kva., three-phase, oil-insulated, water-cooled, connected delta on the low side and star on the high side, the star point being grounded. As water for cooling is expensive, these units are provided with radiators and have 50 per cent capacity when operating as oil-insulated, self-cooled transformers. These stations are relatively close together, being within a radius of twelve miles from the heart of the city, and are interconnected by a sufficient number of tie lines as to give ample capacity for interchange of power and flexibility in operation so that the load can be distributed in the most economical manner. In order to control the division of wattless current between the various stations it was found very desirable to have some means of varying the

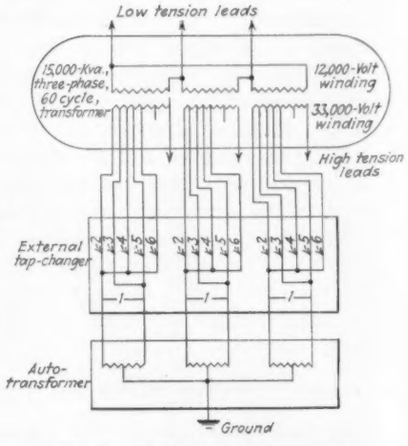


FIG. 1—LINE DIAGRAM OF TAP-CHANGING SCHEME

voltage of the transformers, and so that service would not be interfered with, it was essential that these changes be made while the transformers were carrying load. Auxiliary equipment to make this possible has been specified on all the more recent transformer installations of the company.

A voltage range of 10 per cent

above and below normal was chosen as sufficient to fulfill the requirements, and the tap-changing scheme adopted is one using equipment quite external to the transformer itself. In order to reduce the voltage stress on this apparatus it is placed in the neutral of the 33,000-volt winding and five taps are provided giving voltages in approximately equal steps over the complete range. A further tap is added

FIG. 2—SEQUENCE DIAGRAM SHOWING ORDER IN WHICH THE VARIOUS SWITCHES ARE OPERATED

toward the line end of the winding to give full capacity at 22,000 volts; hence when considered on this basis the voltage range provided by the apparatus is really more than 20 per cent.

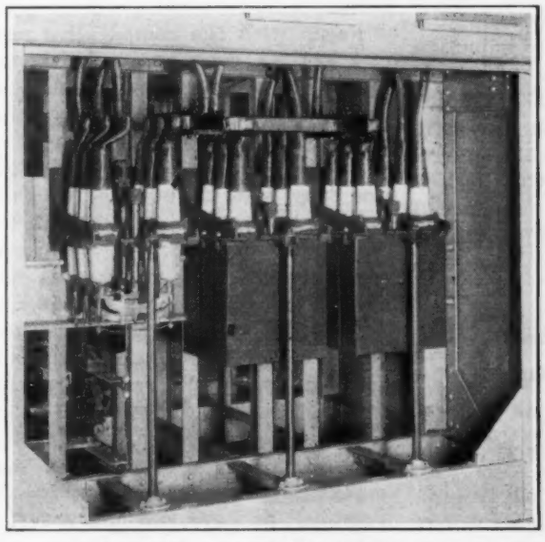
The five leads per phase are brought out through the side of the tank and connected to the tap-changing equipment, which really performs the function of connecting each tap in turn to ground (the whole three phases moving together) so that a voltage range from the highest to the lowest tap is obtained. In order to prevent opening the circuit when moving from tap to tap and also to provide intermediate points, an auto-transformer or reactor is used to bridge between steps; this too is connected to the tap changer and has its middle point grounded. This gives a total of nine points over the entire range, each step being about 2½ per cent of full voltage.

A diagram of connections for the equipment is shown in Fig. 1. Switches 1, 2, 3, 4, 5 and 6 are three-pole type B-2 600-amp., 15,000-volt oil-circuit breakers mounted in an outdoor housing and closed and opened in the correct order by a motor-driven cam shaft. The sequence chart shows the proper operations for these breakers. Suppose that switches Nos. 1 and 2 are closed; then the full high-tension winding is in circuit and 36,300 volts will be delivered. The load current will flow through switch No. 2 and divide with half in each direction through the auto-transformer. As the currents flow in opposite directions, their magnetizing effect is neutralized and the auto-transformer forms no impedance in the circuit. In order to reduce the voltage, switch No. 1 is opened and immediately afterward No. 3 is closed. This connects the auto-transformer across this section of the winding, and as the mid-point of the auto-transformer forms the neutral, a voltage midway between these two taps is obtained. Switch No. 2 is then opened and No. 1 closed, giving a point equivalent to tap No. 3. In this way the auto-transformer can be stepped along from point to point over the entire range and is provided with sufficient current capacity to operate continuously on any of the nine points. It is also designed so that the iron is nearly saturated. This is necessary, as when the short-circuiting switch No. 1 is opened, the current flowing through one-half of its winding is cut off and the load current flowing through the other half becomes magnetizing current and would provide an excessive rise in voltage on the free end of the winding if the core were not arranged to saturate at a voltage slightly above normal.

In order to insure that part of the main transformer winding is not short circuited it will be seen that two tap switches must not be closed at the same time as No. 1 is closed and also, to prevent interrupting the circuit, one tap switch must not be opened until the next one is closed. This necessitates careful interlocking of the various circuit breakers, and is arranged for by means of the cam mechanism used to operate them. The breakers are mounted in two rows of three, one row on each side of the operating shaft as shown in Fig. 3. On this shaft are a series of cams, two for each breaker, one opening and one closing. The breaker is a standard unit except that the operating rod is changed so that in place of the usual closing and latching mechanism there are two hinged shafts with rollers that are operated from the cams. An opening cam was provided, as it was not felt desirable to rely on gravity to open the breaker; in this way very positive action on both closing and opening is secured.

The entire mechanism is driven by a small direct-current motor geared to the shaft. The control panel for this motor is mounted inside the tap changer housing as shown in Fig. 4. A pushbutton station is provided with two buttons, one for raising and one for lowering voltage. A "holding in" drum is also furnished to insure that a full step will always be carried through even if the pushbutton is released before it is completed.

The steel housing for the breakers is of rugged design and has swinging doors provided in the sides and one end so as to facilitate inspection, cleaning or replacement of parts.



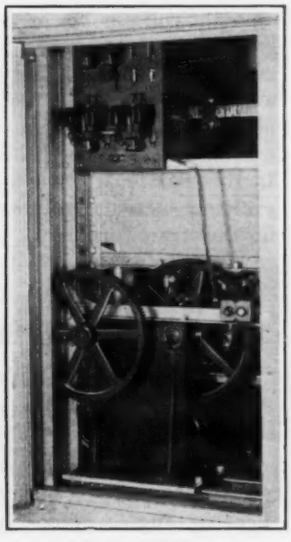


FIG. 3 (AT LEFT)—SIDE VIEW OF TAP CHANGER. FIG. 4 (AT RIGHT)—END VIEW OF EQUIPMENT

Since the tap-changing equipment is placed in the neutral, which is grounded, and the maximum voltage range is 6,600 volts, it is not possible to get more than 3,820 volts above ground on any of the equipment and not more than 6,600 volts between phases. This permits the use of low-voltage apparatus throughout and simplifies the design.

There is nothing unusual in the other equipment involved. The main 15,000-kva. transformer is of normal design except for the large number of taps brought out through the side of the case. The auto-transformer is a three-phase, oil-insulated, self-cooled transformer rated at 664 kva., 964/482 volts with six line leads and the neutral connection brought out.

The three units are entirely separate, the connections between them being easily made, reducing the installation work to a minimum. The internal wiring is completed before shipment, and all that has to be done after receiving the apparatus at its destination is to arrange for its mounting and make the external connections to the bushings. The separation of the two units does not necessitate any radical changes in the design of the transformer either electrically or mechanically; at the same time it saves the head room and weight incident to mounting the apparatus in the top of the transformer tank.

Every tap-changer application requires its own special study, and a scheme highly desirable in one installation may be quite impracticable in others. In some cases the steps obtained by such apparatus as described may be too coarse and a smooth voltage curve desired; this can be done by using an induction regulator between taps which is stepped along from point to point and arranged to give a perfectly smooth curve over the entire range. In this particular case a winding for exciting such a regulator is provided in the transformer if it should be required later.

Desuperheating Steam for Reciprocating Engines

BY W. G. SHURGAR
Superintendent of Power Stations, Arkansas Central Power Company, Little Rock, Ark.

IN REHABILITATING old reciprocating engine-driven plants where some reciprocating equipment is left in the revised plant it is necessary to provide some source of desuperheated steam. This is needed even in modern plants where any reciprocating equipment is installed.

At the plant of the Arkansas Central Power Company, where some reciprocating equipment is occasionally utilized in addition to the turbine-driven equipment, the following method is used: Superheated steam at 250 lb. is employed to operate the turbines and 150 lb. saturated steam for the reciprocating engines. Steam for the latter is drawn from the high-pressure header through a reducing valve and then desuperheated by spraying boiler make-up water into the header on the low-pressure side of the reducing valve. The amount of water so sprayed is controlled by a thermostatic device.

Knowing One's Distribution System

Method Developed by Memphis Power & Light Company for Its Distribution Maps and Records Applicable to Other Companies

DESPITE the fact that the investment in a distribution system of an electric service company may easily approach or exceed that in the generating plant, companies still exist which, if asked some detailed questions regarding their distribution systems, such as size of wire or transformer for a certain location, would be unable to lay their finger immediately on the information. Still, because the distribution system is spread over considerable ground and not concentrated at one point, there is all the more reason why information regarding it should be readily available. Need of such information arises when ascertaining whether a line or the transformers would carry an added load, when extending or interconnecting circuits, when analyzing the most economic layout, etc.

Faced with the comparative need of making a more economical layout of the distribution system, and recognizing the other advantages that come from having complete records thereof, the Memphis Power & Light Company, prior to its recent rehabilitation, developed a plan for distribution system maps and records that might be applicable and valuable to any company of similar size. In general, the distribution system was divided into overhead and underground, so far as record making was concerned, and the general classifications were further subdivided.

In the overhead classification separate maps were made for the 4,000-volt primary, secondary, series, street-lighting, transmission and 11,000-volt distribution circuits. Pole and transformer records were also made separately. In the underground classification, manhole and transformer vault details, duct layout, secondary mains and direct-current system and underground primary cables were treated separately.

The 4,000-volt overhead primary circuits were mapped on tracing cloth (scale 500 ft. to the inch) in order to show individually each primary circuit in skeleton with the size of the wire, whether single-phase or three-phase, and transformer size.

The secondary circuits were mapped on tracing cloth (scale of 100 ft. to the inch with the alleys widened slightly to allow showing poles about ¼ in. in diameter). On this map were shown all poles, pole numbers, distance between poles, secondary wire with size, number of services from each pole, and number and size of transformer. In view of the constant changing of transformers, it was considered best to show them only on an operating sheet (a blue line print mounted on linen) in pencil. All current changes and additions can be made on this operating sheet with black ink and the original tracing brought up to date occasionally. This permits keeping the original tracing in good condition. The operating sheet can be replaced when necessary.

SERIES CIRCUIT MAPS

The series circuits were mapped on tracing cloth (500 ft. to the inch) showing each circuit individually in skeleton, the route and size of wires, location of lamps and lamp numbers, series-type transformers, low-tension series circuits, control switches and regulating transformers. Furthermore, the names of the streets can be indicated without crowding the prints. Street-lighting lamp locations, size and lamp number of all street lamps, were indicated on a tracing cloth map (scale 500 ft. to the inch) omitting all wires.

The transmission and 11,000-volt distribution system were drawn in skeleton on tracing cloths (1,000 ft. to the inch) to indicate all substations, transformers with their numbers and sizes, and wire sizes. Names of streets were also shown along the route where they would be of value.

On the pole-record cards, one of which was made out for each pole, are such data as location, kind of

pole, date set, crossarms, transformers, street light wires, circuit breakers, lightning arresters, etc. On the transformer-record cards, one of which was made out for each transformer, are such data as location, type, size, series number, record of load, and pending loads added after each load test. Transformer records were applied to the underground systems and 6,600-volt transformers as well.

Detailed drawings of each manhole or vault (scale ¼ in. equals 1 in.) have been considered the best for showing manhole and transformer vault details such as location, kind and number of ducts, location and size of transformer equipment, rating of cables and ducts, construction of manholes, whether drained, type of cover, etc. The ducts between manholes were shown on separate tracings (100 ft. to the inch) indicating the location of manholes, manhole numbers, service boxes, individual duct lines and distance between centers of manhole covers.

The secondary mains and direct-current systems were mapped on tracing cloth similar to the ducts, except that the duct runs were not shown. The lines connecting manholes to represent cables were marked to indicate the size and number of conductors. Symbols were used to indicate transformers and junction boxes. Separate maps were made for each type of secondary distribution systems and also for the direct-current system.

The underground primary cables were traced similar to the secondary maps and showed manholes and vaults, cable sizes, number of conductors, transformer, oil switches and junction boxes. Lines between manholes represented cables.

Washing Dirty Insulators with Fine Water Spray

By F. W. H. Wheadon
Engineer and Manager Adelaide Electric Supply Company, Ltd., Adelaide, Australia

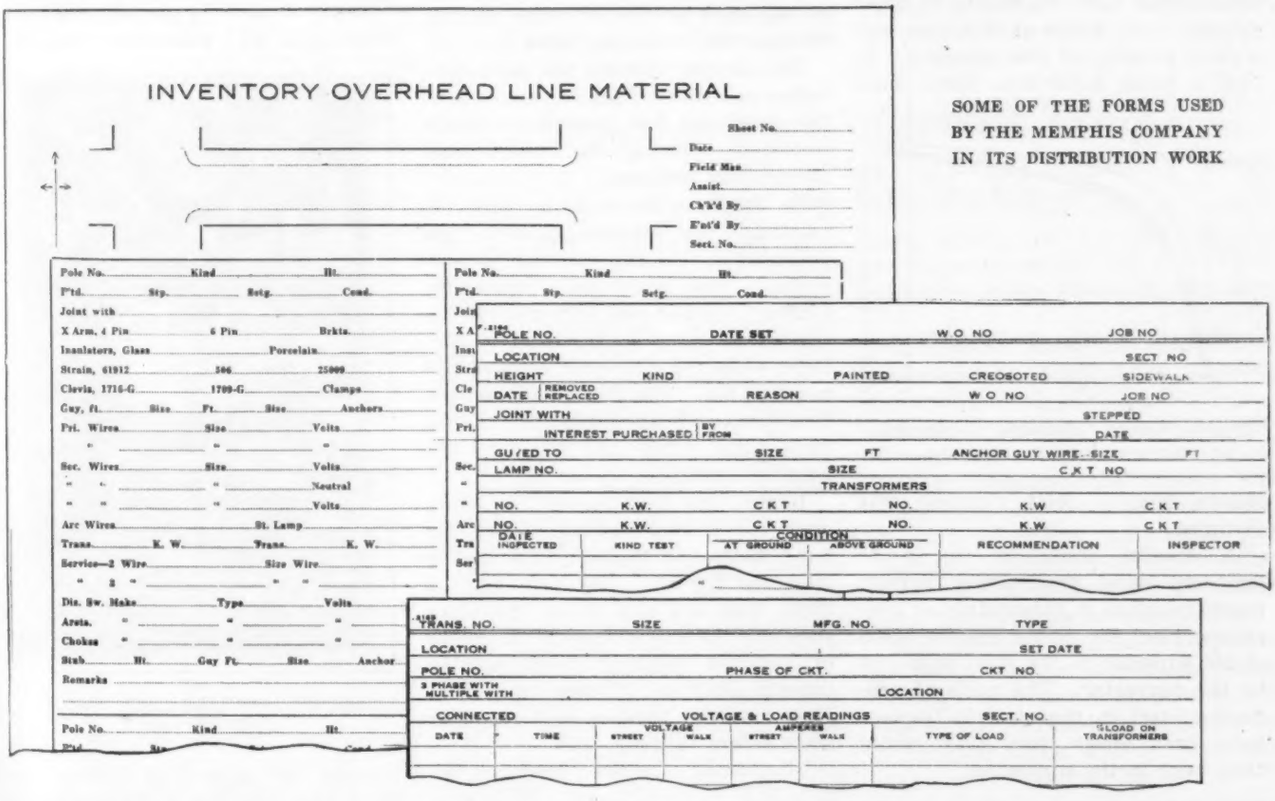
SOME trouble has been experienced at one of the 33,000-volt substations of this company due to insulators flashing over. This substation is located near cement and chemical works, where salt and cement dust deposit very rapidly. This difficulty has been overcome by periodically washing the insulators that are subject to these unfavorable conditions of atmosphere.

This is now done with the bus alive, about once a fortnight, with a hose fitted with a fine nozzle connected to the town water mains. Precaution is taken that the metal nozzle of the hose is efficiently earthed. It might be thought that such a practice was not only dangerous but would result in insulators flashing over; there is, however, no sign of any flow of current, the finely divided spray through the small nozzle being insufficient to cause serious leakage.

Generator Motored to Find Phase Rotation

IN PLACING its new Copco No. 2 hydro-electric plant on the line recently, the California Oregon Power Company determined the correct phase rotation by starting up the generators as motors. To do this it was necessary to obtain a clear line into the plant from one of the other stations and connect to it a generator in the new plant and one in the other plant which could be started up so that both machines would come up to speed together.

By exciting the field of the generator in the new plant it would start as an induction motor and indicate whether or not the rotation was correct. This method of operating the generators in the new plant also saved several weeks' time in getting the plant on the line. The generators were completed several weeks before water could be put through the turbines and by operating the generators as motors in the manner described it was possible to


INVENTORY OVERHEAD LINE MATERIAL
Sheet No.
Date
Field Man
Assist.
Ch'k'd By
E'nt'd By
Sect. No.
Pole No. Kind Ht.
P'td. Stp. Setg. Cond.
Joint with
X Arm, 4 Pin 6 Pin Brkts.
Insulators, Glass Porcelain
Strain, 61912 306 25009
Clevis, 1716-G 1709-G Clamps
Guy, ft. Size Ft. Size Anchors
Pri. Wires Size Volts
Sec. Wires Size Volts
Neutral
Arc Wires St. Lamp
Trans. K. W. Trans. K. W.
Service—2 Wire Size Wire
Dis. Sw. Make Type Volts
Arsts.
Chokes
Stub Ht. Guy Ft. Size Anchor
Remarks
POLE NO. DATE SET W.O. NO. JOB NO.
LOCATION SECT. NO.
HEIGHT KIND PAINTED CREOSOTED SIDEWALK
DATE REMOVED REPLACED REASON W.O. NO. JOB NO.
JOINT WITH STEPPED
INTEREST PURCHASED BY FROM DATE
GUYED TO SIZE FT ANCHOR GUY WIRE SIZE FT
LAMP NO. SIZE C.K.T. NO.
TRANSFORMERS
NO. K.W. C.K.T. NO. K.W. C.K.T.
DATE INSPECTED KIND TEST CONDITION AT GROUND ABOVE GROUND RECOMMENDATION INSPECTOR
TRANS. NO. SIZE MFG. NO. TYPE
LOCATION SET DATE
POLE NO. PHASE OF CKT. CKT. NO.
3 PHASE WITH MULTIPLE WITH LOCATION
CONNECTED VOLTAGE & LOAD READINGS SECT. NO.
DATE TIME VOLTAGE STREET WALK AMPERES STREET WALK TYPE OF LOAD LOAD ON TRANSFORMERS

SOME OF THE FORMS USED BY THE MEMPHIS COMPANY IN ITS DISTRIBUTION WORK

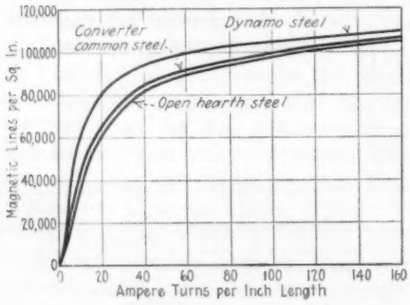
run in the bearings and get the machines ready for immediate operation as soon as water was available. The generator windings were previously dried out with auxiliary heat instead of by the usual method of drying them with their own heat while operating on short-circuit.

Electric Furnace Replaces Converter

Castings Equal if Not Superior to Former Method—Operating Costs Lower—Uniform Results Assured

BY F. E. HINNERS,
General Manager George H. Smith Steel Casting Company, Milwaukee

FOR many years the George H. Smith Steel Casting Company, Milwaukee, Wis., has made all of its steel castings by the converter process. When the electric furnace came into prominence there was some doubt as to its ability to make dynamo steel, which at that time was a chief product of this company. In 1921 a 3-ton, 2,500-kva., three-phase



ELECTRIC STEEL SUPERIOR IN PERMEABILITY TO CONVERTER STEEL

Moore Electro-Melt furnace was installed.

A careful study of the problem and some preliminary experiments resulted in fabrication of low-carbon steel for motor frames equal if not superior to the steel produced by the converter. The costs of producing steel in the electric furnace have been lower than they would have been in the converter.

TABLE II—TYPICAL DAY'S RUN WITH ELECTRIC FURNACE IN PLANT OF GEORGE H. SMITH STEEL CASTING COMPANY

Heat	1	2	3	4	5	6	7	8	9	10
Charge, lb.	5,280	6,015	6,350	6,200	6,130	6,100	6,260	6,150	6,150	6,810
Kw.-hr.	2,200	1,725	1,800	2,100	1,850	1,750	2,475	1,750	1,800	1,800

TABLE III—MONTHLY PRODUCTION AND POWER CONSUMPTION OF FURNACE

Month	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Tons steel	558	468	485	465	494	426	418	432	475	349	595	815
Kw.-hr.	608	606	617	574	598	599	587	588	591	609	596	576

This company operates a jobbing foundry producing five grades of steel for gears, crane parts, tractor parts, ditching machinery and electric apparatus. These steels have carbon contents ranging from 0.07 to 0.35 per cent. An idea of the type of castings produced may be gained from a study of the accompanying illustration.

The physical and chemical properties, including yield point, tensile strength, elongation and reduction, of the steel produced in the electric furnace are shown in Table I.

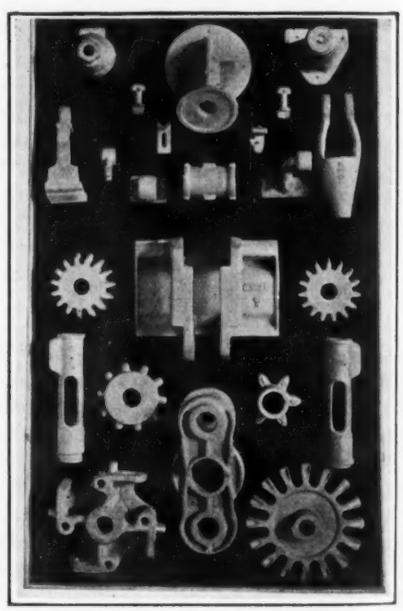
The electric furnace has permitted better control of chemical analysis of the steel and has been particularly useful in reducing the sulphur and phosphorus content.

In addition to making superior castings, the electric furnace has operated at less expense than a converter. One important feature resulting in lower cost is the ability to charge all scrap in the electric furnace, while the converter required 40 per cent pig. The charge of the electric furnace is approximately 65 per cent plate scrap and 35 per cent foundry scrap.

Labor has been saved by using charging chutes instead of the old hand method of shoveling the charge into the furnace. By this method three men are able to do the work formerly done by six men. A saving of rejected castings is effected by careful analysis of everything that goes into the furnace and frequent tests before tapping.

The 3-ton furnace produces an average of ten heats per day, some days reaching fourteen heats. The operating schedule is arranged to keep the furnace off the system peak of the power company, and the economy of this practice is indicated by the fact that the combined furnace and power load earns an average rate of $0.009 per kilowatt-hour of energy used. Any additional energy over the present requirements of this furnace would cost even less per kilowatt-hour.

Tables II and III give the kilowatt-hours used and pounds of material



SPECIMEN CASTINGS FROM ELECTRIC STEEL FURNACE

charged for each heat during one day's run and for a twelve-month period.

The maximum demand of the furnace is 1,550 kw. With a furnace temperature of 3,300 deg. F. the consumption of the 12-in. electrodes averages 18 lb. per ton of steel. The furnace linings of acid silica brick, bound together with ganister cement, have a life of more than 200 heats. The roof of this furnace has a life of 290 heats.

TABLE I—CHARACTERISTIC PULL-TEST DATA OF 20/0.30, 30/0.40 C AND C-N-M STEELS IN THE ANNEALED CONDITION

Yield Point	Tensile Strength	Elongation	Reduction	Remarks
20/0.30 Plain Carbon Steel:				
39,000—46,400	65,000—78,450	22%—32%	24%—48%	Regular annealing
41,000—60,200	73,200—94,300	24%—35.5%	38%—52%	Special annealing
30/0.40 Plain Carbon Steel:				
45,000	85,000	25%	35%	Annealed
45,000—65,000	90,000—110,000	22%—30%	25%—40%	Special annealing
C-N-M Steel:				
70,000	108,000	21	38	Annealed
75,000	122,000	20—24	35—45	Special annealing

The above data refer to the standard 2 in. x 0.505 pull test and represent ranges rather than individual tests, since the strength as well as the ductility varies with analysis within the ranges of carbon indicated.

Commercial Activities and Public Relations

Energy Consumption and Cost of Electric Water Heating

AVERAGE monthly consumption of energy by electric water heaters installed by residential customers is 574 kw.-hr. where continuous automatic hot water service is supplied and 210 kw.-hr. where water is heated intermittently, according to figures compiled by the electric water heating committee of the commercial section, N.E.L.A. These data were taken from the records kept by nine central-station companies having a combined total of 7,183 metered electric water heaters on their lines. The accompanying tabulation gives the average monthly kilowatt-hour consumption as found by each company for both automatic and manually operated installations. The sizes of tanks that are recommended by the different companies for various size homes are shown in Table II.

More than two-thirds of all the heaters reported are 4 or 5-kw. heaters. About 85 per cent of the water heaters reported are used in conjunction with electric ranges and 15 per cent where no ranges are installed. Of all the water heaters reported, 87 per cent are circulation type heaters. Of the water heaters reported, 58 per cent are equipped with thermostats and 2,447 of these are supplying continuous hot water service.

All the water heaters reported are operating on standard cooking and heating schedules, most of which are designed to throw the water heating on the two-cent rate. Two companies have one and one-half cent blocks and one a two and one-half cent block. However, all but a few hundred of the water heaters reported are operating on the two-cent rate, so that the heater supplying continuous automatic hot water service, using an average of 574 kw.-hr. per month, produces a revenue of $11.48 per month. The intermittent heater using 210 kw.-hr. earns $4.20 per month.

Where continuous hot water service is maintained, the load factor is largely controlled by the heater capacity. For instance, a 3-kw. automatic heater using 574 kw.-hr. will have a load factor of 26½ per cent.

Virtually all of the nine companies are recommending 1.5-kw. to 3-kw. heaters without double-throw switches in average homes where the heater is to maintain continuous hot water service and 4 or 5-kw. heaters with double-throw switches where water is to be heated only intermittently.

The double-throw switch appears to be satisfactory where the heater capacity is relatively large, whether or not the water is kept hot, but usually not satisfactory when heaters are smaller than 4 or 5 kw.

Electric water heating is a success on a meter rate of two cents per kilowatt-hour. On this rate about one-third of all the water heaters reported are supplying continuous automatic hot water service. However, the proportion of consumers maintaining continuous hot water with its desirable effect on load and revenue will naturally increase or decrease as the rate for such service increases or decreases.

Experience with Electric Trucks

Analysis of Operating Costs of Trucks in Milling and Baking Service —Results of Tests in Packing Industry

ELECTRIC haulage costs of a large bakery, Cushman & Sons Company, and a milling company, Hecker-Jones-Jewell Milling Company, of New York City, have been carefully recorded and analyzed, with the result that these companies are thoroughly convinced of the superiority of the electric truck over horse-drawn vehicles or gasoline trucks for metropolitan short-haul delivery service.

The milling company had formerly used gasoline trucks for its short-haul service and since the substitution of electric trucks has come to the following conclusions:

1. Electric trucks average 296 working days a year, against 285½ days for gasoline trucks.

2. Carefully kept cost records of both types indicate the electric truck's maintenance cost at just half that of gasoline trucks of the same size.

3. Electric trucks are much easier to control in traffic than gasoline trucks.

4. Most accidents occur between 5 p.m. and 7 p.m., according to records, because both drivers and pedestrians are tired at that time. The ease of control and comparative freshness of drivers of electrics, because of no gear-shifting, makes them less likely to have accidents.

The company figures depreciation on its trucks on a ten-year basis (though a fifteen-year life is expected), on nickel-iron batteries on a five-year basis and on lead batteries on a three-year basis.

TABLE I—MONTHLY KILOWATT-HOUR CONSUMPTION OF ELECTRIC WATER HEATERS

Company	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Average Monthly Consumption
Monthly kilowatt-hour consumption where continuous automatic hot water serivce is supplied	324	...	544	...	100	987	527	...	489	574
Monthly kilowatt-hour consumption where water is heated intermittently only. (Manually operated)	...	278	207	...	...	360	160	159	150	210

Note:—The numbers 1 to 9 refer to the same reporting company throughout the report.

TABLE II—SIZE TANK RECOMMENDED FOR USE WITH ELECTRIC WATER HEATERS IN VARIOUS SIZE HOMES

Power Company	Small Homes, Gal.	Average Homes, Gal.	Large Homes, Gal.
1	18 to 30	30	.....
2	30	..	.....
3	24 to 30	30	50 to 60
4	.....	30	.....
5	18	24	30
6	30	40	60
7	30	30	52
8	.....	..	.....
9	30	40	60 to 80

TABLE I—COST ANALYSIS OF FIVE-TON TRUCK USED BY MILLING COMPANY

Days operated	296
Round trips	666
Number of stops	9,324
Tons hauled	3,330
Miles traveled	9,768
Fixed Expenses:	
Interest	$165.00
License	55.00
Garage	59.20
Insurance	296.00
Fixed expense for year	$575.20
Fixed expense for month	47.93
Fixed expense per day	1.94
Variable Expenses:	Per Mile
Depreciation for minimum life of 97,680 miles	$0.0465
Maintenance and repair; $266.40 for 9,768 miles	.0273
Tire cost; $458 for 17,000 miles	.0270
Charging cost; 9,650 kw.-hr. at 5c. per kw.-hr., $482.50 for 9,768 miles	.0494
Battery maintenance and renewal; $692.64 for 9,768 miles	.0709
Variable expense, total	$0.2211
Fixed expense	.0589
Total cost (ex. driver's wages)	.2800
Cost per day (ex. driver's wages)	8.2361

TABLE II—COST ANALYSIS OF FIVE-TON TRUCK USED BY BAKERY

Days operated	669
Number of trips	3,791
Number of deliveries	3,791
Tons hauled	22,291
Mileage	12,058
Fixed Expense:	
Interest	$231.37
Licenses	55.00
Garage	420.00
Insurance	240.00
Fixed expense per year	$946.37
Prorated for period	2,294.79
Fixed expense per month	78.86
Fixed expense per day	3.43
Variable Expense:	Per Mile
Depreciation for minimum life of 100,000 miles	$0.0401
Maintenance and repair; $969.28 for 12,058 miles	.0804
Repair due to accident	.0000
Tire cost, $299.12 for 10,000 miles	.0299
Charging cost, 17,873 kw.-hr. at 5c. per kw.-hr., $893.65 for 12,058 miles	.0741
Battery renewals, $865.42 for 12,058 miles	.0718
Variable expense, total	$0.2963
Fixed expense	.1903
Total cost (ex. driver's wages)	.4866
Cost per day (ex. driver's wages)	8.7695

TABLE III—OPERATING COST DATA OF ONE-TON BAKERY TRUCK

Days operated	351
Number of trips	526
Number of deliveries	17,550
Tons hauled	399
Mileage	12,285
Fixed Expense:	
Interest	$154.00
License	25.00
Garage	300.00
Insurance	168.00
Fixed expense per year	$647.00
Fixed expense per month	53.91
Fixed expense per day	1.84
Variable Expense:	Per Mile
Depreciation for minimum life of 150,000 miles	$0.0150
Maintenance and repair, $300 for 12,285 miles	.0244
Repair due to accident	.0000
Tire cost, $160.90 for 10,000 miles	.0161
Charging cost, 6,600 kw.-hr. at 4c. per kw.-hr., $264.00 for 12,285 miles	.0215
Battery renewals, $318.60 for 12,285 miles	.0259
Variable expense, total	$0.1029
Fixed expense	.0527
Total cost (ex. driver's wages)	.1656
Cost per day (ex. driver's wages)	5.4448

The baking company substituted electric trucks for horse-drawn wagons and all heavy trucking is now done exclusively by the electrics. Three five-ton trucks and one three and one-half-ton truck replaced twelve horses and four wagons. The horses replaced were unusually heavy, and extra animals had to be kept to give an occasional rest to the others, since the loads averaged nearly six tons. The work of the heavy trucks consists chiefly of hauling flour from terminals to the various bakeries, the trucks averaging six trips totaling eighteen miles a day. The company now has a fleet of 149 trucks, the smaller sizes used for bread delivery being of one-ton and one-half-ton capacities.

It has been found that truck repairs are very light, that they can be made quickly and that for work involving much starting and stopping the electric trucks are superior to either horse-drawn or gasoline trucks.

Tables I and II give the cost analysis of operation of five-ton trucks by the milling and baking companies. The various items parallel each other quite closely and the total daily cost of operation is very close. Table III gives the cost of a one-ton truck used by the baking company and is naturally somewhat lower than the same cost for the five-ton trucks.

Raising Domestic Use of Energy

THE Northern States Power Company in directing new-business operations to increase kilowatt-hour sales per dollar of plant investment has enlisted the aid of a competitive spirit among division managers, particularly with respect to energy consumption by residential customers. Friendly competition has been found a more effective incentive to productive selling than executive insistence, and each month each division manager receive a bulletin giving the average kilowatt-hour sales per residential customer in his own and other divisions.

Analyses of the causes of a decrease or only slight increase in consumption are used as the basis for determining what local sales activities can be adopted that will best serve to raise the residential customer's use of energy. When interpreting these reports, due allowance is made for the effect of territorial expansion in lowering the average kilowatt-hour sales per meter, as it is recognized that newly acquired territory cannot at once be built up to the average of the division. The accompanying tabulation shows how the residential consumption for a twelve-months period is compared with that of the previous months, together with each division's standing.

Utah Company Establishes Domestic Refrigeration Rate

THE Utah Power & Light Company has filed with the Public Utilities Commission of Utah a new rate schedule providing for a special domestic refrigeration rate for electric energy. Heretofore domestic refrigeration has not been included in its rate schedules.

The new schedule virtually gives consumers the choice of three rates: 10, 5 or 3 cents per kilowatt-hour. The 10-cent rate is the regular lighting rate, subject to 10 per cent discount for prompt payment. The 5-cent rate is the new special refrigeration rate, also subject to a prompt payment discount of 10 per cent. The 3-cent rate is the cooking rate, which has been in effect for some time in the company's territory.

ANNUAL RESIDENCE LIGHTING KILOWATT-HOUR CONSUMPTION PER RESIDENTIAL CUSTOMER

Northern States Power Company, Minneapolis, Minn.

Position August 1924	Division	Year Ended May 31, 1925	Year Ended April 30, 1925	Increase or Decrease Kw.-Hr.	Increase or Decrease Per Cent	Net Increase or Decrease, May, 1925, Over August, 1924 Kw.-Hr.	Net Increase or Decrease, May, 1925, Over August, 1924 Per Cent
1	Minneapolis	414.2	414.2	....	....	10.5	2.60
3	Fargo	368.1	368.3	0.2*	0.05*	19.1	5.47
2	St. Paul	352.4	353.1	0.7*	.020*	3.0	0.86
4	Stillwater	341.0	339.5	1.5	0.44	49.8	17.10
5	Sioux Falls	286.9	288.3	1.4*	0.49*	0.5	0.17
6	Minot	283.7	284.1	0.4*	0.14*	1.4	0.50
9	Menkato	270.9	272.1	1.2*	0.44	18.9	7.50
7	Grand Forks	270.3	270.6	0.3*	0.11*	1.8	0.67
8	Ottumwa	262.7	262.8	0.1*	0.04*	1.6	0.61
10	Wisconsin	250.7	250.7	....	....	14.7	6.23
11	Southwestern	237.7	237.1	0.6	0.25	22.5	10.45
12	Faribault	222.9	222.7	0.2	0.09	9.1	4.26
13	Galena and Platt	215.9	216.1	0.2*	0.09*	3.1	1.46
	Average	351.9	352.0	0.1*	0.03*	10.4	3.04

*Decrease.

A customer who receives only lighting service from the company may operate his electric refrigerator on the lighting rate, through the same meter; or such customers may have a separate meter installed for current used in domestic refrigeration and pay for such current at the 5-cent rate. Customers who now have electric range service on the 3-cent cooking rate may also operate a domestic electric refrigerator without an additional meter, paying the same rate for refrigeration as for cooking.

Where the special meter for refrigeration service is installed, the monthly minimum charge is $1.11 gross, subject to 10 per cent prompt payment discount.

An Electrified Hotel Kitchen

BY ROBERT I. SMITH
Industrial Power Engineer Connecticut Light & Power Company, New Britain, Conn.

THE advantages of electric heat for cooking and baking and in the preparation and serving of a large number of meals daily have been shown very decidedly in the first year's operation of the electrified kitchen of the Hotel Burritt at New Britain, Conn. This hotel, which is one of the most modern and attractive of its type in the New England States, is operated by the United Hotels Corporation and was first opened in March, 1924.

Since the opening of the hotel the Connecticut Light & Power Company, which serves this customer, has kept a close watch on the operations carried on in the electric kitchen, and the following data in regard to cost, number of meals served, load characteristics, etc., are very interesting.

During the first year's operation little trouble was experienced with the cooking apparatus. A set of broiler units proved to be defective at the start and were promptly replaced by the manufacturers. One unit in the bake oven gave out, and this trouble was corrected very quickly with no inconvenience to the hotel in any way.

DEMAND AND ENERGY CONSUMPTION OF ELECTRIFIED HOTEL KITCHEN

Month Ending 1924	Light and Power		Cooking and Baking		Total	
	Kw. Demand	Kw.-Hr.	Kw. Demand	Kw.-Hr.	Kw. Demand	Kw.-Hr.
April 14.....	20.70	12,770	70.50	14,400	91.2	27,170
May 12.....	16.80	10,160	72.00	13,020	88.8	23,180
June 16.....	22.10	10,370	61.90	15,660	84.0	26,030
July 14.....	21.14	9,450	60.46	11,640	81.6	21,090
Aug. 14.....	22.10	10,120	61.90	13,440	84.0	23,560
Sept. 15.....	22.10	11,100	61.90	15,500	84.0	26,600
Oct. 13.....	15.86	9,460	63.34	15,220	79.2	24,700
Nov. 12.....	15.20	8,150	61.60	19,020	76.8	27,170
Dec. 12.....	12.40	10,962	61.60	16,778	84.0	27,740
1925						
Jan. 12.....	24.80	11,780	61.60	17,670	86.4	29,450
Feb. 13.....	28.80	14,660	57.60	16,500	86.4	31,160
Mar. 12.....	25.94	6,590	60.46	18,300	86.4	24,890

The accompanying table covering the first twelve months' operation, from March 15, 1924, to March 15, 1925, shows the demand and energy consumption for the lighting and power requirements of the hotel and for the electrified kitchen separately.

An approximate check of the number of meals served, which is increasing from month to month as the hotel becomes better known and more and more patronized by tourists, indicates that the number of meals served per month at present is about 20,000. Dividing this into the number of kilowatt-hours consumed for baking and cooking, there is an approximate consumption per meal served of 780 watts. This figure, the hotel management anticipates, will be even smaller as time goes on, owing to the fact that a considerably increased number of meals can be served with no increase in use of facilities over that now existing.

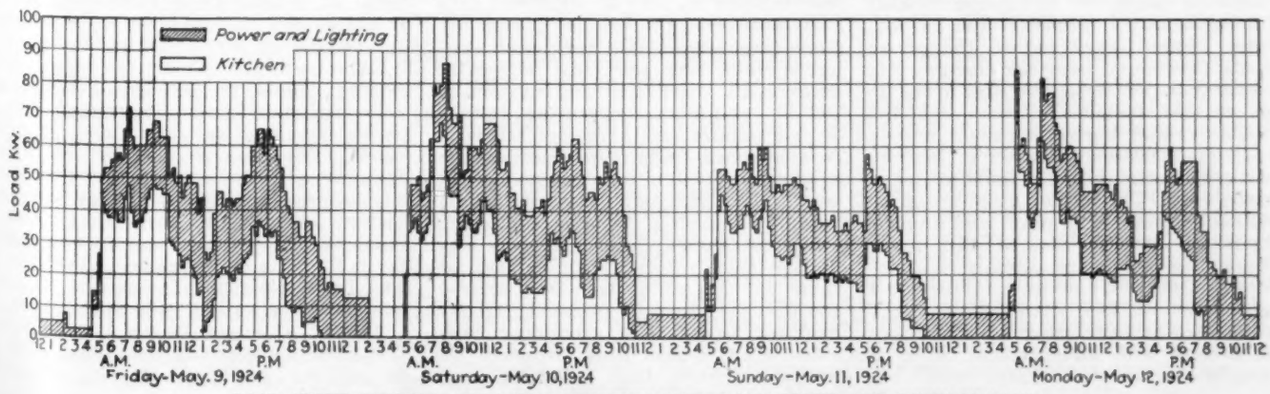
Herewith is a typical load curve for four days, from May 9 to 12 inclusive, which may be of interest to those who have feared that this type of load is not desirable and profitable to power companies. The cross-hatched area represents lighting and power load, while the lower portion represents the kitchen load. The points on this curve were obtained from two fifteen-minute demand meters, one connected to the main circuit and the other to the kitchen circuit.

When this installation was first proposed, it was estimated that the hotel by electrifying its kitchen and combining the consumption there with its ordinary lighting and power consumption would obtain such a favorable over-all cost for lighting, power and cooking that it would save nearly what the entire bill for gas would be if gas fuel were used instead of electricity. On this basis electricity is cheaper by far for the hotel than any other type of fuel which could be used in the kitchen.

EQUIPMENT INSTALLED AND CONNECTED LOAD OF EACH UNIT

No.	Equipment	Connected Kw., Each	Total Kw.
2	Ranges	22.0	44.0
1	Broiler	10.0	10.0
1	Toaster	3.0	3.0
2	Waffle irons	1.6	3.2
1	Bake oven	8.4	8.4
1	Frying griddle	3.0	3.0
	Total connected load.....		71.6

The hotel management appears to be extremely well pleased with the results obtained from the installation thus far, not only from the cost standpoint, but because of the greater cleanliness due to the absence of fuel, ashes, smoke and fumes in the kitchen and the greater flexibility and ease of operation.



LOAD CURVE SHOWING RELATION BETWEEN POWER AND LIGHT AND COOKING LOAD

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Pulverized Fuel in European Plants.—C. H. S. TUPHOLME.—Operating results are reported for several modern plants. A normal evaporation of 10.5 lb. and maximum of 14 lb. per square foot of heating surface is one of the guarantees; another is that power used is not to exceed 2 per cent when allowing 20,000 B.t.u. per unit generated. At the Amsterdam Electricity Works the excess air from a mechanical stoker is utilized to complete the combustion of pulverized fuel, the two being used in combination.—*Power Plant Engineering*, June 15, 1925.

Recent Developments in the Burning of Anthracite.—W. A. SHOUDY and R. C. DENNY.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the annual meeting of the A.S.M.E. at New York, December 13, 1924, on page 1263. As now published it contains a large mass of data on evaporative and other tests at the Amsterdam (N. Y.) station of the Adirondack Power Company.—*Mechanical Engineering*, July, 1925.

World's Record High-Head Reaction-Type Hydraulic Turbine.—C. P. DUNN.—The turbine in question is a vertical unit of the Francis type, revolving at 514 r.p.m. and developing 35,000 hp. with a discharge of 400 cu.ft. per second under a net head of 850 ft., at the Oak Grove station of the Portland (Ore.) Electric Power Company Dam. Spillway, pipe line and surge tank design are discussed and illustrated; a map shows the relation of this base-load plant, which is ultimately to be increased to 105,000 hp., to the rest of the system.—*Power*, June 2, 1925.

Hydro-Electric Plant Pont-de-Claix (France).—J. REYVAL.—Situated in the center of a large electro-chemical and metallurgical industry, this new 14,000-kva. plant relieves not only an acute local power shortage, but has enough surplus energy to assist neighboring generating stations over a tie-line during their dry season. At the confluence of the Rivers Drac and Romanche a dam has been erected from which leads an open and cemented canal of 745 m. length to the penstock. This latter is made of reinforced cement tubing 6 m. in diameter and 1¼ km. long. Immediately before the power house this round penstock changes into rectangular cross-section and drops 18 m. to the turbines. There are five double runner horizontal shaft wheels, each of 3,000 hp. installed at present, with all cement work finished for a sixth unit. The author goes into great detail describing the novel and unusual hydraulic construction of this plant. Each turbine drives directly a 2,800-kva., 5,500-volt, 50-cycle, three-phase generator at 300 r.p.m. with direct-connected exciter. Most of the energy is carried with underground cables to nearby consumers at 5,500 volts. For the tie-line a transforming station of 5,500 volts to 26,000 volts and 2,000 kva. capacity is provided.—*Revue Générale de l'Electricité*, June 20, 1925.

Generation, Control, Switching and Protection

Lightning Disturbances and Lightning Protection.—A. MATTHIAS.—The importance of lightning protection and the utter need of a really satisfactory lightning arrester were the reasons why a special research committee was established in Germany a few years ago, which made it its purpose to study the entire situation from the electrical and meteorological standpoint, and to start a sort of card-file-index of all lightning disturbances, the details of which were fully and exactly known. The present article, written by the chairman of this committee is a report of its up-to-date findings. A theoretical study of origin, nature and propagation of thunderstorms in general constitutes the first part of this paper, and is based chiefly on the recent investigations of Norinder. It is pointed out that while this author has actually demonstrated the frequent occurrence of exceedingly high electrostatic potential differences between ground and such a height above ground, as overhead lines are suspended, this high voltage does not cause any particular trouble on account of the very pronounced leakage of all supports of the line, and also due to this more or less local charge being distributed over the entire length of the line to the right and left. When diagnosing lightning troubles, it will in very many cases be difficult to distinguish between disturbances due directly to lightning and those due to secondary actions accompanying the former. The fact that a lightning bolt advances in its path about 300 times slower than the propagation of electricity, may account for the frequently called strange effect that wires into which a bolt hit are not melted. In such a case, a large amount of electric energy travels up into the lightning bolt, it is claimed, counteracting its effect. Illustrations are shown where lightning splintered wooden poles up to the point where the pole guy wire starts, whence it descended through this wire without melting it. Recorded data show that medium voltage plants are more endangered than very high voltage plants, but the once advocated assumption that lines and system of 100 kv. and higher operating voltage do not require any arresters seems to be abandoned today. An excellent insulation of the line is considered as the most effective help toward safety against lightning troubles, although other authorities claim that this may harbor more danger than safety, because in case of a flash-over greater energies may thus be released. Of undisputed benefit is a grounding cable above transmission lines, although the author believes that probably only several of such cables over one line will give full protection. Horn gaps and simple choke coils are unsatisfactory, he claims. Corona discharge arresters are used freely but no definite judgment is yet available. Modern condensers at least do not fail as older designs did. Bendmann arresters are claimed to be capable of diverting safely considerable amounts of energy. Grounding coils have given in general good service except those with high inherent inductivity. Very much recommended is a reliable Y-grounding at several points. A dangerous practice is to be satisfied with a reflection of oncoming overvoltage waves, because every reflection is accompanied with a very considerable increase of potential. Great hopes are entertained from research work with the very recently developed cathode-ray oscillograph, with which experimenters have succeeded for the first time to study accurately the nature of exceedingly short transients, such as occur in lightning disturbances.—*Elektrotechnische Zeitschrift*, June 11, 1925.

Exciter Practice in Electric Power Stations.—H. M. RANKIN.—The excitations systems of twenty-five representative power stations, steam and hydro-electric, are listed in a table that shows the rating and number of main generators and of exciters, type of exciter drive, and other details. Such considerations concerning current practice are discussed as the amount of spare exciter capacity desirable in a station, the use of automatic voltage regulators, and the general question of the stability of exciters.—*Power Plant Engineering*, June 15, 1925.

Transmission, Substations and Distribution

Evolution of Alternating-Current Secondary Networks.—H. RICHTER.—This article sketches historically the development of low-voltage networks and describes different forms that have been adopted in various cities. The several types are shown by diagrams.—*Electric Journal*, July, 1925.

Agricultural Uses of Electricity.—F. RINGWALD.—In an address given recently by the author statistical figures were given for the use of electric light and power on Swiss farms. A review made of all the existing larger farms gave the following average figures for the whole country: 90 per cent of all farms are electrically supplied with light; there are an average of sixteen lamps on each of these farms; 3.3 hp. in motors are installed per farm, consuming 160 kw.-hr. annually; 0.8 kw.-hr. are used per person per day for cooking; 1,600 kw.-hr. are used per boiler and year for fodder cooking; five kw.-hr. are used per day for heating water. Based on a tariff of 100 for light current, 35 for power current, 17 for cooking current and 9 for water heating current the surprisingly low figure of only one franc per farmer per day is found to be consumed in Switzerland for electricity. To improve these conditions the author calls attention to a number of lesser known but profitable uses of electricity on farms, such as milking machines, forcing plant

growth in hot houses by installed lights, drying and conserving of fodder electrically, artificial rain installations, electric sterilization of cider, use of electric appliances in cheese factories, electrically equipped chicken hatcheries, and others. Authentic data are furnished for all these operations, taken from actual operating experiences.—*Bulletin de l'Association Suisse des Electriciens*, June, 1925.

Outdoor Substation Practice.—This article contains notes on modern practice, discusses factors affecting design, describes equipment used and gives illustrations of a number of stations and of special details.—*Power Plant Engineering*, July 1, 1925.

Units, Measurements and Instruments

An Electrometer Method for the Measurement of Radio-Frequency Resistance.—P. O. PEDERSEN.—The author criticises the existing methods for the measurement of radio-frequency resistance and describes a new method, where a quadrant electrometer is put across the inductance in an oscillatory circuit. The condenser of this circuit is charged to the voltage V_0 and discharged through the inductance by means of a special key. The throw of the electrometer will then be proportional to $V_0^2 - L/2R$. The theory of the method is given and it is shown how to eliminate the different possible sources of error. The radio-frequency resistance of even a very feebly damped circuit may be determined with an error well within one part in a thousand, and this determination may be made in a few seconds.—*Proceedings of Institute of Radio Engineers*, April, 1925.

Windage Losses in Air, Hydrogen, and Carbon Dioxide.—CHESTER W. RICE.—This paper begins with an experimental study of the comparative windage loss when a disk is rotated in each of the gases named. The problem is also investigated analytically by applying the method of dimensions, requiring only the experimental determination of an empirical constant. By this analysis an equation for turbulent motion is derived:

$$W = KA\rho v^3 \times 10^{-7} \text{ watts}$$

where

$K = 0.001$ to 0.005.
A = area of surface in sq.cm.
ρ = density of gas or liquid in grams per cubic centimeters.
v = average velocity of fluid relative to the surface in centimeters per second.

The analysis is further applied to the case of centrifugal pumps and electrical machinery. Assuming turbulent motion, the windage loss of a 31,250 kw., 1,800-r.p.m. generator is computed, and found to be 311 kw. (checked by observation to be 325) in air, and only 32 kw. in hydrogen.—*General Electric Review*, May, 1925.

The Asymmeter.—C. SCHMITTUTZ.—Equal potential and equal load on all three phases in three-phase networks is the ideal condition for safe and efficient system operation. How near to this ideal condition a plant is operating can only be determined by a simultaneous reading on three voltmeters for the potential and on three ammeters or wattmeters for the load. A new instrument is available on the German market which represents a great advance in measuring instruments. In one round case, only slightly larger than the usual switchboard type meter, are arranged three moving elements, connected to the three phases. The motions of these three elements are tied over three fine metal wires, forming the legs of a Y, to a common central point, holding there a small round disk. As scale is used a polar co-ordinate system. If the forces exerted upon the three moving elements are alike, the disk will remain in the center of the scale, otherwise the disk will be displaced in accordance with the obtaining asymmetry. The three systems may be high-resistance windings for potential indication or low-resistance for current measurements. The position of the disk in front of the polar scale will therefore indicate at any instant the exact location of the neutral of the plant.—*Elektrotechnische Zeitschrift*, June 18, 1925.

New Electromagnetic Oscillograph.—R. DUBOIS—Within the large pole pieces of an electromagnet is lodged a coil the number of turns and the wire size of which depend upon the use of the oscillograph. Within this coil is placed a small iron rod, balancing in the middle upon a knife edge, and held at its two ends by opposing springs. The front end of the rod transmits its motion over a piece of fine thread to a small concave mirror. If no current flows through the winding of the coil the iron rod is in unstable equilibrium. An exceedingly small current is sufficient to tilt the rod up or down, depending upon the direction of the current. The motion of the rod is made dead-beat by either oil-immersing the entire lower part of the apparatus or by introducing a few drops of thick oil around the swinging rod in the narrow gap between the pole pieces of the large magnet. For this new instrument are claimed very low cost, very high sensitiveness and great power, so that an unusually large mirror can be used. The apparatus gives excellent records of up to 3,000 cycles per second. A large number of records taken with this new instrument show the great variety of measurements for which it can be used. The high degree of sensitiveness makes this new oscillograph particularly suitable for telephone and radio investigations in connection with vacuum tubes.—*Revue Générale de l'Electricité*, June 20, 1925.

Heat Applications and Material Handling

Electric Melting of Quartz.—M. HELLBERGER.—The unusual and useful properties of fused quartz in the shape of heat resisting vessels, panes and optical lenses have created a large demand for this material. Commercial manufacture of it was, however, impeded by the lack of an inexpensive manufacturing method. Another problem was the chemical constitution of the crucible, so as not to affect purity or color of the fused quartz. The author has designed an electric resistance furnace, where the silicon-carbide crucible itself forms the resistance. It was found that this crucible material does not have any noticeable effect upon the melt. A further trouble was experienced with the frequent occurrence of air bubbles in the finished quartz, which made its use for optical purposes impossible. This obstacle was successfully overcome by inclosing the crucible air tightly and fusing under vacuum, followed later by finishing the process under heavy gas pressure (20 atm.). The present furnaces, in which temperatures of over 2,000 deg. C. can be reached, have a quartz capacity of ½ kg. and give fused quartz of perfect quality. An average energy consumption of 50 kw.-hr. per 1 kg. finished product has been obtained.—*Zeitschrift des Vereines Deutscher Ingenieure*, June 27, 1925.

Electrophysics, Electrochemistry and Batteries

Theory of the Magnetron Taking into Account the Variation of the Mass of the Electron with Velocity.—LEIGH PAGE.—In this analysis it is shown that the exact expression for the critical voltage necessary to drag electrons to the cylindrical anode, with coaxially arranged electrodes, gives results appreciably different from those with the approximate theory which ignores the change of mass of the electron with change of velocity. The divergence amounts to some 2 per cent for a critical potential of 20,000 volts and increases approximately in proportion to the voltage. Since this potential corresponds to an axial field of the order of 200 gauss or a filament current of the order of 700 amp. it should be possible to verify by experiment the exact theory.—*Physical Review*, June, 1925.

Electrolytic Calcium Arsenate.—STEWART J. LLOYD and A. M. KENNEDY.—An electrolytic method has been developed for converting trivalent arsenic in the form of common white arsenic (As_2O_3) into the less dangerous pentavalent arsenic in the arsenates, corresponding to As_2O_5, used as an insecticide. White arsenic is dissolved in caustic soda in the proportion of 198: 250 parts to form a basic sodium arsenite solution. When this is electrolyzed between iron electrodes, hydrogen and a small amount of metallic arsenic (about 1 per cent of the As_2O_3 used) are produced at the cathode. Only a small amount of oxygen is evolved at the cathode, the remainder serving to convert the sodium arsenite to arsenate. The filtered arsenate solution is then added to a suspension of calcium hydroxide, whereupon a precipitate of calcium arsenate is formed. The electrolysis is carried on in marble boxes or vats 8½ ft. long. 5 ft. wide and 4 ft. deep, divided by iron plates into 100 cells, holes in the plates permitting the liquid to be circulated continuously until the oxidation is 99 per cent completed. Each plate serves as a bipolar electrode. A current density of 30 amp. per square foot of single surface is used, requiring about 3 volts per cell. The paper under review

gives the equations for the reactions involved, shows a flow sheet of the process and plant layout, and describes the equipment and operating procedure in detail.—*Chemical and Metallurgical Engineering*, July, 1925.

Traction

Storage Battery Locomotives for Northern Pacific.—The locomotives in question are stated to be two of the largest storage battery locomotives that have ever been built, as is evident from the following data:

Weight of locomotive	70 tons
Length inside of coupler knuckles	42 ft.
Motors	Four, 250-volt
Weight of battery	17 tons
Tractive effort	42,000 lb. at 30% adhesion

The battery is charged while the locomotive is in service. A motor-generator set on the locomotive is connected to transformers on the coal loading shovel by a flexible cable while cars are being spotted at the shovel. This operation takes about one and one-half hours, during which time a sufficient charge can be given for the trip to the yard.—*Railway Age*, May 30, 1925.

Automatic Substations on the Melbourne Suburban Railway System, Australia.—R. M. HARVEY.—An example is given of automatic equipment applied to the control of some 8,000 kw. of 1,500-volt direct-current railway substation apparatus. The electrified lines amount to 360 miles of single track; sixteen substations are in operation; five of them are completely automatic and contain in all eight 1,000-kw. rotary converter units. Seven of the units operate about 620 times per annum, while the eighth, in the station most remote from Melbourne, cuts in 3,845 times during the same period. In the article the sequence of events in starting or stopping a unit is described, as well as various automatic features for protecting the machines when the conditions are abnormal, an indicating system, and provision for remote control. Cost data thus far obtained indicate that the annual expense is considerably lower than it would be if the same stations were manually operated. A map and illustrations accompany the description.—*General Electric Review*, July, 1925.

Telegraphy, Telephony, Radio and Signals

Telephone Receiver Impedance.—E. Z. STOWELL.—In a note on this subject the author gives the results of measurements of impedance at frequencies between 6,000 and 1,000,000 cycles per second on about fifty pairs of telephone receivers. The resistance variation method was used. It is found that the receivers have an electrical natural frequency quite distinct from that of the diagram, at which the resistance suffers a great increase; above it they behave like a condenser with rather large dielectric loss. In general the natural frequency is between 9,000 and 15,000 cycles per second, the resistance at the natural frequency 100,000 to 200,000 ohms; above 50,000 cycles the telephones may be considered a condenser of the order of 10^{-10} farad, with a resistance inversely proportional to frequency; around 1,000,000 cycles receivers differ little among themselves, the capacity of the leads apparently furnishing the major portion of their impedance.—*Proceedings of Institute of Radio Engineers*, April, 1925.

Signals and the Saving of Fuel.—B. J. SCHWENDT.—In advocacy of the use of signals instead of train orders it is stated that road tests with regular five-car passenger trains (about 300 tons trailing weight) showed a saving of roughly 280 lb. when running through, as against making a stop and immediately starting. A stop with a freight train of 1,610 tons gross weight, involving a loss of about fifteen minutes, is estimated to cost about $6.25 in wages, fuel and repairs. Other savings can be made by substituting machine switching and automatic signals for manual switching by train crews, by improvements in track lay-out, by installing interlocking devices at crossings and substituting three-position in place of two-position signals.—*Railway Age*, May 30, 1925.

Some Artificial Lines and Networks Associated with the Uniform Telephone Transmission Line.—It is shown analytically that the problem of constructing a network the impedance of which shall be equal to that of an infinite telephone line can be solved exactly by the use of a number of sections of simple artificial lines. Some of the artificial lines can be used for attenuation correction. It is further shown that related networks can be obtained such that when placed in series or in parallel with the infinite uniform line the impedance of the combination is a pure resistance.—*Journal of I. E. E.*, June, 1925.

New Books

Switchgear for Electric Power Control

By E. B. Wedmore and Henry Trencham, 329 pages, illustrated. Oxford University Press, American Branch, New York, N. Y.

While based on English equipment and experiences this book contains more fundamental considerations and less catalog material than most books covering this live aspect of power generation and distribution. Fuses, circuit breakers, reactors and protective schemes for cables and feeders are treated in a fundamental manner. Oil and airbreak switches are discussed in the light of experience, and some very pertinent comment is made on the use of resistance or reactance breaks.

Especially good treatment is given on the protection of parallel feeders, special cable protective schemes and the methods used to protect individual consumers. Equipment in this field is changing so rapidly and the requirements are so variable that it is refreshing to find a book so largely devoted to principles of control and protection. It should find a welcome at the hands of American and English engineers.

Electricity and the Structure of Matter

By L. Southerns. London: Oxford University Press. 128 pages, illustrated. Price, $1.

In the first section of this book a brief sketch is given of the history of the subject up to the discovery of the electron in so far as is necessary to introduce the terms and ideas employed in the later sections. In considering electric currents and their applications the author discusses free electrons, the heating effect of electric currents, electromagnets, telegraphy, telephony, generators and motors.

Under radio activity he covers the alpha and beta rays and their nature, disintegration of atoms, gamma rays and ionization. He then considers the atomic architecture going into the constitution, size and weight of atoms, Maxwell's theory of light and the visible and invisible regions of the spectrum. In the concluding two chapters he takes up electromagnetic waves and atomic aggregates.

Book Notes

An Outline of Automatic Telephony. By William Aitken, London. Ernest Benn, Ltd. 143 pages, illustrated. Price, 5s. net.

It will be remembered that Mr. Aitken, a recognized authority on automatic telephone systems, is the author of a comprehensive treatise on the subject in three volumes. In the small book which has just come from the press he discusses the essential features of all important systems now in general use and includes sufficient detailed information to meet the requirements of a large class of readers. The material is presented in a clear, concise and usable form which should cause the book to appeal to all who are interested in automatic systems.

Physics in Industry. By I. W. Mellor, A. E. Oxley and C. H. Desch. 48 pages. Oxford University Press, American Branch, New York.

The field of the physicist in industry is rapidly broadening, as pointed out by Sir Charles A. Parsons in a foreword to this compilation of three lecturers by noted physicists before the Institute of Physics. The lectures deal with applications of physics to the ceramic industries, to the textile industries and to the metallurgical industries. Instructive and illuminating lectures by three such noted physicists prove conclusively the value of the scientist to industry.

Fernmeldeleitungen beim Elektrischen Zugbetrieb der Deutschen Reichsbahn. By O. Brauns and W. Wechmann. 99 pages, 37 illustrations. Berlin: Verein Deutscher Ingenieure.

A commission of electrical engineers and telephone experts from five European countries investigated the inductive and other interferences between the 16⅔-cycle, single-phase, 15,000-volt overhead lines of the German federal railways and the signal, telephone and telegraph lines near by. Their findings and recommendations for improvements are laid down in this little book.

Power Station Operation. Vol. 1. *Electrical Times*, Ltd., London, England. 100 pages, illustrated.

A compilation of questions and answers made from the weekly discussions in the *Electrical Times*. Engineers have asked and answered many specific and practical questions dealing with all phases of power-station operation.

Book Received

Lehrbuch der Elektrotechnik—Volumes I and II. Leipzig: Verlag von Wilhelm Engelmann. 753 illustrated pages, Volume I; 826 illustrated pages, Volume II.

News of the Industry

Pinchot's View of State Regulation

Governor of Pennsylvania Holds that "the Only Purpose of a Public Service Commission Is to Protect the Public Interest"—Removes Two Commissioners

GENERALLY accepted as is the view that state public service commissions are quasi judicial bodies whose chief duties are to prescribe rates for public utility companies that will bring a fair return on an uninflated valuation, to insist on good service and to mediate justly between companies and customers when disputes arise, this conception fails to satisfy Governor Gifford Pinchot of Pennsylvania, who last week, in dismissing from office Commissioner James S. Benn, appointed by a previous Governor, declared in a formal letter:

"The purpose, and the only purpose, of a public service commission is to protect the public interest. It cannot rightly have another object. Unless it acts as the militant advocate and vigilant protector of the rights of the people, it is useless or worse.

"No public service commission that expects to serve the public can afford merely to wait for cases to be submitted to it. It must act upon its own initiative. The vital duty of a public service commission is, upon its own motion, to protect the public. To do so it must seek out, take up and deal with cases in which the public interest is involved but which without its action would never come before it.

"One most serious fault of the average public service commission is that it is satisfied to decide cases on the information before it, when it is obvious that the public side has not been adequately presented. It can do its duty only by making certain that the facts are as fully presented on the public side as on the corporate side. When the facts are equally presented on both sides the commission should be the judge, but simply to act as a judge on the evidence, knowing full well that the public side has not been brought out, is just another way of deciding against the public. In a private case the contestants in the long run will be equal. In utility cases they seldom are."

After dwelling on the duty of a public service commission to keep its standards and policies up to date, Governor Pinchot concludes:

"It is equally true that the welfare of the public requires that corporations which do adequately serve the public shall receive a fair return, no less and no more, upon the money invested in them. Unless public utility corporations properly handled and giving proper service to the public are permitted to earn reasonable returns upon the money actually and prudently invested, new money will not be invested, necessary extensions of line and service will not be made, and the public interest will suffer.

"It is therefore as much the duty of a public service commission militantly active in the public interest to safeguard the legitimate interests of the corporations as it is to safeguard the legitimate interests of the public. The cases in the history of public utilities in the United States in which the interests of the companies have been overlooked are, however, rare, while cases in which the interests of the public have been forgotten are innumerable."

COMMISSIONERS WILL FIGHT

The reason for Governor Pinchot's dismissal of Mr. Benn was disapproval of his attitude in valuation and fare proceedings affecting the Philadelphia Rapid Transit Company which are now before the commission. For the same reason he dismissed also Commissioner S. Ray Shelby on August 5, leaving no commissioner not his own appointee on the board except Chairman W. D. B. Ainey. The Governor's power, under the constitution and laws of Pennsylvania, to take such summary action is disputed, and Mr. Benn and Mr. Shelby have declared that they will continue to function as commissioners, despite the fact that Dr. Clyde L. King, Secretary of the Commonwealth and former professor of political science in the Wharton School of the University of Pennsylvania, has been named by Governor Pinchot as successor to the former. Dr. King has made somewhat extensive studies of utility and related matters.

Ready for Shaver Lake Job

Southern California Edison Announces Further Work on Big Creek-San Joaquin Project

WORK on the Shaver Lake tunnel and conduit line, which will connect Huntington Lake, the great storage reservoir of the Southern California Edison Company in the High Sierras, with Shaver Lake, will be commenced early next winter. Starting of the actual work on the Shaver Lake project will begin another important era in the Southern California Edison Company's Big Creek-San Joaquin River project, and an expenditure of about $37,000,000 on hydro-electric development during the years intervening between the present and 1930 is contemplated.

This combination tunnel and conduit will tap Huntington Lake at the upper end of the second dam and will have a total length of about five and a third miles. The tunnel proportions will be 12 ft. in diameter with a capacity of 1,250 sec.-ft. Where the route crosses Big Creek and Pitman Creek 9½-ft. steel pipe is to be used. At Shaver Lake, an artificial reservoir with a capacity of but 6,000 acre-feet of water, it is intended to construct a dam which will impound 139,000 acre-feet of water and add approximately 180,000 hp. to the present generating capacity of the Big Creek-San Joaquin project. This dam will be below the present lake and will be approximately 220 ft. thick at the base with a height of approximately 190 ft.

With the completion of the Huntington-Shaver Lake tunnel the Southern California Edison Company will have completed more than 30 miles of tunnel since it resumed active construction operations following the war. The total expenditure for water-power construction, reservoirs, power houses, transmission lines to local centers, with the completion of the project which has just been authorized, will bring the investment of the Southern California Edison Company in its hydro-electric program at Big Creek up to $123,000,000.

Still in First Stages

Report that Trade Commission Has Completed Its General Electric Investigation Denied

A REPORT that the investigation of the General Electric Company has been completed is denied by Chairman Van Fleet of the Federal Trade Commission. The inference from the report was that the commission had had no difficulty in establishing all the facts necessary for its conclusions. Mr. Van Fleet asserts that there is nothing to justify any such report. It is expected that several months of work will be necessary.

An indication of the thoroughness with which the commission is preparing for this investigation is had in the fact that the economists assigned to the investigation have made a detailed study of the plant of the Potomac Electric Power Company in Washington, so as to familiarize themselves with the conduct of a large central station. It has been decided to report on some of the engineering phases of the business.

The report that the investigation had been concluded came on the heels of a revival of the erroneous statement that the commission had dropped the General Electric study on the ground that such work was precluded by the appropriation act which became effective July 1. As was explained at that time, the appropriation act was interpreted as applying to a small portion of the work only. The major purposes of the Senate resolution are being carried out diligently.

The investigation has not progressed very far. Little work on it could be done prior to July 1, owing to the necessity of concentrating personnel on the investigations which had to be concluded before the end of the fiscal year. Since July 1 there has been some delay in getting the work under full headway because of the vacation season. It was stated at the commission's offices that

the General Electric Company is placing no obstacles in its way and has shown every disposition to co-operate.

New Middle West Purchase

Takes Over Southwestern Gas & Electric, Operating in Shreveport and Texarkana

THE Rufus G. Dawes interests have sold to the Middle West Utilities Company, of which M. J. Insull is president, all of their stock holdings in the Southwestern Gas & Electric Company. The communities served are Shreveport, La., where the company conducts the entire electric light and power and gas business; Texarkana, Tex.-Ark., where electric light and power, gas and street-railway services are furnished, and nineteen nearby communities supplied with gas. The company serves a total population of approximately 180,000. Gross earnings for the year ended December 31, 1924, were $3,868,993. The company has had a steady record of growth, gross earnings over the past five fiscal years increasing 74 per cent.

The Middle West Utilities Company has announced that there will be no important changes in the personnel of the local management of the company. L. S. Wescoat is vice-president and general manager. Including this purchase, the Middle West Utilities Company now serves through its operating companies 1,307 communities in nineteen states. This is an increase of 500 communities served since July 1, 1924.

First Revocable Permit Issued in Oklahoma

The first revocable permit to be issued under the law passed at the last session of the Oklahoma Legislature was granted on July 21 to the Okmulgee Gas Company against the protest of the city authorities, who will appeal to the courts on the ground that the law is unconstitutional. This law gives public utility companies the right to surrender municipal franchises and receive revocable permits from the state in lieu thereof, but, contrary to statements by its opponents, public utilities desiring to supply electric or gas service still must obtain municipal franchises. On this point E. F. McKay, manager of the Oklahoma Utilities Association, says:

"The new law does not take away the right of cities and towns to vote on franchises, and no utility that does not already hold or does not hereafter secure a municipal franchise has any rights whatsoever under the provisions of this bill. Although the new law is now in full force and effect, several cities in the state have just held or will soon hold franchise elections. Under the new law these applicants for franchises could not secure the right to operate in competition with utilities already affording service unless the Corporation Commission should hold public convenience and necessity to require the additional service; but even with such holding the utility proposing to enter the field must still secure a franchise from the people before acquiring the right to occupy the streets or alleys of the city."

Lancashire's New Power Station

The Ribble electric power station at Preston, England, was formally inaugurated on July 22 by Sir John Snell, the chairman of the British Electricity Commission, who opened the valve admitting steam to one of the two 12,500-kw. turbo-alternators at present installed. A third set of similar capacity is to be added later. Although the station is the property of the Preston municipality, it forms one link of a chain that should before long extend from the Lancashire coast to the Pennines and serve the increasing demands of both the industrial and residential population over a wide area in Mid-Lancashire. Work is proceeding on an underground transmission line capable of transmitting 10,000 kw. at 33,000 volts. The new Preston station has cost, it was stated at the ceremonies, $95 per kilowatt. The third generating set will, when installed, reduce the average cost to $75, and a fourth set would bring it down to $65 per kilowatt.

America Has Part in French Power Exposition

The American section of the Power Exposition at Grenoble, France, was opened recently by Sheldon Whitehouse, the United States Chargé d'Affaires, while two Cabinet members represented France. The exhibit contains models of hydro-electric resources, including the plants at Niagara Falls and Muscle Shoals, and shows the development of water power in the United States. The American Chamber of Commerce in France is responsible for the exhibition.

The Société Française des Electriciens held a two days' conference at Grenoble on July 10 and 11, when papers were read on "Hydro-Electricity and Railway Electrification," by M. Pasodi, chief of the electrical section of the Orleans Railway Company; "The State of the Electrical Industry in Lebanon," by Father Beampois, professor at the University of Beirut, and "The Characteristics of Hydraulic Turbines for Electricity Generating Purposes," by Georges Routin of the University of Grenoble. At a joint meeting with the Syndicat Professionel des Producteurs et Distributeurs d'Energie Electrique, M. Picault, chief engineer of French telegraphs, read a paper on "The Influence of Electricity Transmission Lines on Telegraph and Telephone Lines," and M. Brylinski one on "Conditions of Coexistence of Electricity Transmission and Tele-communication Lines."

Rate to Toronto Power Users Up 75 per Cent Since 1918

The *Financial Post* of Toronto quotes the rate of $25 per horsepower which is now being charged to Toronto power users by the Toronto Hydro Commission because of the increase in the price charged by the Hydro-Electric Power Commission of Ontario for Niagara energy as a startling indication of how the cost of Hydro service is being increased. This rate is $10.50 per horsepower higher than was charged in 1918 and it is $6.50 per horsepower higher than charged in 1921 before the Toronto Power Company was absorbed. In 1918 Toronto bought 60,154 hp. at $14.50 per horsepower. Last year it took 191,803 hp. at $25. The newspaper points out that the increases which have been made have been confined to industrial and commercial consumers, while the domestic rates to the public have remained almost unchanged. Between 1920 and 1921, for instance, the commercial rate was advanced from 2.2 cents to 4 cents per kilowatt-hour, while the average industrial rate was advanced from $20.33 to $32.13 per horsepower-year.

Electragists Try New Plan

Afternoon Sessions to Be Closed at Three-Day Convention at West Baden, Ind.

ANNOUNCEMENT that J. H. Trumbull, Governor of Connecticut and president of the Trumbull Electric Manufacturing Company, who was formerly an electrical contractor, will make the principal address at the quarter centennial of the Association of Electragists International was made at the association's headquarters this week, when the tentative program for the convention at West Baden, Ind., September 23, 24 and 25 was issued.

The program this year marks a departure from the order of previous years in that the afternoon sessions are to be executive in character and open only to members of the association. Instead of four days, as has been the custom, the convention will be in session on only the three days named. There will be open sessions each morning, when invited speakers representing other branches of the electrical industry will be heard. The afternoon of the third day is reserved for field sports, and each evening will be filled with entertainment, including a costume ball on Wednesday evening and a play and minstrel show on Thursday evening. Presentation of the James H. McGraw award to the man adjudged to have made the most important personal contribution to the advancement of the contracting branch of the industry will be made on Thursday at noon. On Friday night the Electragists will act as hosts to the central-station men attending the convention of the Great Lakes Division of the N. E. L. A. at French Lick Springs, a mile away. In order that all may have an adequate opportunity to study the manufacturers' exhibits the convention will not open any morning until 10.30 o'clock. The program as so far arranged follows:

WEDNESDAY, SEPTEMBER 23

Morning.—President's statement; address, Governor J. H. Trumbull of Connecticut; "The Jobbers' View of Distribution," O. Fred Rost.

THURSDAY, SEPTEMBER 24

Morning.—Address, Martin L. Pierce, director of research, Hoover Company; address, William S. Boyd, secretary and treasurer Western Association of Electrical Inspectors; "Uniform Electrical Ordinance," S. L. Nicholson; presentation of McGraw award

FRIDAY, SEPTEMBER 25

Morning.—Address, W. J. Canada, electrical field secretary N. F. P. A.; address, Sherman L. Rogers, associate editor *Success.*

Evening.—Central-station night.

Rate Reduction Ordered in Boston

Eight and a Half Cents to Be Edison Company's Maximum Charge—Long-Standing Case Ends—Commission Discusses Depreciation, New-Business and Lamp Policies

BY AN order issued last week the Massachusetts Department of Public Utilities reduced the maximum price of electricity on the system of the Edison Electric Illuminating Company of Boston to 8.5 cents per kilowatt-hour and closed a case which has been in the hands of the state regulative authorities in one form or another for the greater part of a decade. Since the filing of the consumers' petition in 1916 the company had voluntarily made a number of reductions in its maximum rate, the last being in September, 1922, to 9.5 cents per kilowatt-hour. Four petitions were before the board, three being complaints against prices brought by consumers (including one by the city of Boston) and one from the company, which sought to obtain higher rates from certain large consumers. The city and the company recently reached an agreement in the matter of street-lighting rates, and at that time the city and company agreed to settle the former's petition concerning rates if the company would reduce the residence "A" rate to 8.5 cents.

The company contended that its increased requirements for taxes, dividends and interest charges made it impossible to make any further reduction in its present maximum rate (9.5 cents) unless provision for depreciation were waived for 1925 or a reduction were made in the rate of dividends now paid on its outstanding stock. The appropriation to depreciation reserve and surplus increased from $803,829 in 1922 to $1,894,891 in 1924, the gross operating revenue increasing in this period from $15,885,819 to $19,494,784. In 1924 the company passed to its depreciation account $1,800,000, or about 2.6 per cent of its depreciable property.

Consumers' Contentions

The main contentions of the consumers were that the appropriation to the depreciation reserve has been excessive and that the rates to large consumers have been unduly low and made at the expense of those paying the maximum rate.

The commission commends the action of the company in appropriating larger amounts to its depreciation reserve in 1923 and 1924. At the same time it points out that the policy of the company in regard to its depreciation reserve in the past has tended to result in a high investment compared with the amount of electricity sold, and the board contrasts the lower maximum rates at Worcester and Cambridge, Mass., although the company maintained that these systems are not properly comparable with its own.

With the contention that the rates charged to large consumers have been unduly low and made at the expense of those who pay the maximum rate the commission is inclined to agree. The board feels that this has also tended to compel the company continually to expand its capital to meet the added necessities of its generating system. Referring to the contracts with large consumers from which the company seeks relief, the decision says in part:

"These contracts were made at these low rates to induce the customers to abandon projects to install private plants. The company now recognizes that these contracts, in view of the changed conditions, at least are unfortunate. Moreover, these contracts were of a nature to increase the peak of the company's load. It is to be observed that the 'A' rate customers who pay the rate in issue contribute nearly one-half of the revenue of the company and use but approximately one-fifth of the electricity sold. Moreover, users of approximately three-fifths of the electricity sold pay prices averaging from 3 cents down to 1.2 cents per kilowatt-hour.

"A policy of selling electricity at a rate very close to, if not below, cost, in order to secure the business of those who might otherwise install their own steam power or electric generating plants, and which forces a company frequently to increase its generating capacity and to issue large amounts of securities and capital stock to meet the cost of these enlargements, thereby constantly increasing its investment and its interest and dividend charges, holds little hope to the ordinary user of electricity of securing in the future his electricity at a low cost. Even if this were a wise policy in the long run from the point of view of the company, it ought not to be carried to such lengths that the ordinary member of the public is compelled to carry an undue burden while it is being accomplished. It is asserted by the company that the policy of encouraging the use of electricity for power by selling it at a low rate results in making it possible to sell to the ordinary user electricity at a rate lower than the company otherwise would be able to sell it. Undoubtedly to a certain extent this is true, particularly when such electricity sold for power is used in the hours of the day when the use of electricity for lighting purposes is small and when its sale does not increase the peak of the company's load, as it thus tends to use up the generating capacity of the company and enable it to produce its electricity at a less unit cost. We believe, however, that this policy may be carried to excess and when so carried to excess does not result in the lowering of the cost to those paying the maximum price. When one compares results with that of the Worcester company, he is led to the belief that the policy of selling electricity for power at very low rates has been carried to excess by the Edison company.

Free Lamp Policy Not Inimical

"Counsel for the consumers criticises the policy of the company in furnishing lamps of 50 watts and over to customers free of charge and asserts that such practice should be abolished and the company should be ordered to sell all lamps to its 'A' rate customers at cost. We are disinclined to make any such order, both for the reason that we doubt our authority to make such requirement and because we are not at all convinced that the practice is not a desirable one.

"Counsel for the consumers also asserts that the management has been extravagant and improvident. In addition to his claim that the company has sold electricity below cost he contends that it undertakes great construction work and purchases coal without competitive bids, that it has sought to obtain a monopoly of lighting and power over a large area, that such efforts have induced it to enter into improvident contracts and to incur large expenses for new business and advertising.

"We have already alluded to the company entering into some contracts which were believed to have resulted in loss to the company. We are inclined to believe that the company has been too eager to obtain power business which it feared it might lose by reason of private electric or steam plants. Its expenses in 1924 for new business, exclusive of advertising—$207,061—and for advertising—$274,000—impress us as large, particularly as the payers of the maximum rate receive slight, if any, benefit therefrom. Evidence has been introduced which indicates that in some instances at least the company's construction costs are high. Not sufficient evidence, in our judgment, has been introduced to warrant the conclusion that it is paying or has paid an excessive amount for coal. All these, however, are matters of management over which we have no control except to the extent we may consider them in coming to a decision in fixing rates. . . .

"These [large power] contracts illustrate the impropriety of public utility companies entering into time contracts in order to obtain business. In our judgment a public utility, at least of the character of the Edison company, should have definite rates open to all of the public situated in like circumstances. Time contracts are never justifiable except possibly with other public utilities, and then they should be subject to revision at reasonably frequent intervals to meet changes in conditions.

Market Price and Yield

"The company says that a reduction of the rate even to the extent suggested by it and acquiesced in by the Mayor of Boston can be made only by the postponement of all provision for depreciation in the year 1925. This we do not concede. The rate will apply but for a part of the year. The company is now paying dividends at the rate of 12 per cent upon the par value of its capital stock. The rate in 1907 was raised from 10 per cent to 11 per cent and in 1912 from 11 per cent to 12 per cent. Twelve per cent is approximately 7.6 per cent upon its capital stock and premiums paid thereon. Its stock in the market is now selling for over $200 a share, which indicates that the public is willing to invest its money in the stock of the company when the return thereon is somewhat less than 6 per cent. A reduction of its dividend rate to 11 per cent would yield approxi-

mately 6.9 per cent upon the capital and premiums and a reduction to 10 per cent about 6.3 per cent, which is a better rate upon the capital stock plus premiums than that which those who now buy the stock in the open market realize from their investment. We do not subscribe to the thought that dividends of a public utility should move in one direction only and that up. Obviously during the periods of high interest rates dividends must often be increased to enable a company readily to dispose of its stock at par. On the other hand, we know of no reason, when the public interest so requires, why high rates of dividends may not be reduced when it will not impair the company's ability readily to obtain new capital, and particularly when done in order to maintain an adequate provision for depreciation. It follows that we do not approve the postponement of provision for depreciation in order to comply with an order made by us fixing rates.

REVENUES WILL GROW

"The establishment of a maximum rate of 8.5 cents would, if the company's business remained the same as in 1924, cause a reduction in its revenues of approximately $970,000 a year. This would mean less than half of that amount in 1925. Its revenues, however, we expect, will be considerably larger in 1925 than in 1924. Its income from the city of Boston will be substantially larger. It can, in our judgment, make a substantial saving in its expenditures for advertising and new business. Moreover, by readjustments in its rates below the maximum rate it can effect increases in its revenues.

"After consideration of all the factors involved we are of the opinion that the company can reasonably be required to sell electricity at a maximum rate of 8.5 cents per kilowatt-hour. The company contends that its free lamp service amounts to more than half a cent per kilowatt-hour in value to those paying its maximum rate. Counsel for the consumers asserts it amounts to no more than 3 mills. In our judgment it approximates half a cent, and thus a rate of 8.5 cents is in substance the same as a rate of 8 cents without the privilege. A minority of the commission are of the opinion that the rate should be made 8 cents with the lamp privilege, in view of the possibility of increased revenue from a readjustment of the other and lower rates."

New England Power Starts Sherman Bridge Plant

Another automatic hydro-electric plant will be built at once on the Deerfield River in Massachusetts by the New England Power Construction Company of Worcester, Mass., to add 6,000 kva. to the New England Power Company system. Bids on the machinery are now being prepared, and it is planned to complete the development by the fall of 1926.

Clifford R. Oliver, assistant general manager of the New England Power Company, states that the installation will be at Sherman Bridge, near the Massachusetts-Vermont state line, and that its completion will enable the company to utilize the discharge water from all three of the Davis Bridge plant units without spilling at the present No. 5 station farther down the river, since the Sherman Bridge development will provide reservoir capacity between Davis Bridge and No. 5 sufficient to conserve the water above the last-named station, which is at present the "neck of the bottle" on the Deerfield system. This means the utilization of 22,000 kva. without waste, as the full value of the third 16,000-kva. unit now being installed at Davis Bridge cannot be had until the Sherman Bridge pondage is available.

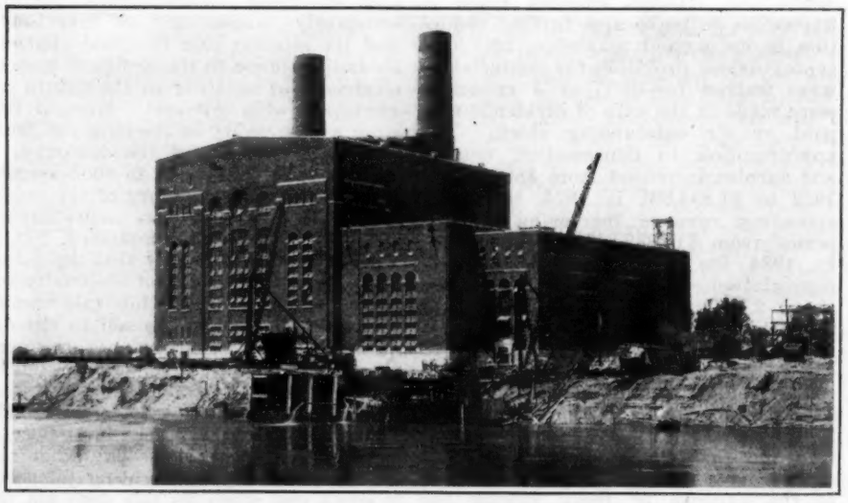
The new development represents a routine step in the utilization of the river and includes the construction of an earth dam 700 ft. long, 95 ft. high and 500 ft. in maximum width. The generating plant will be located at the dam and will house a vertical unit whose discharge will be into the head of the No. 5 development now in use. The head of the Sherman Bridge development will be the tailrace of the Davis Bridge plant. Sherman Bridge will be connected with the 110-kv. switch yard at Davis Bridge by a 110-kv. line about two miles long. The estimated cost of the development is about $1,600,000.

Winnipeg Electric and Hydro Reach Agreement

Announcement is made that the Winnipeg Electric Company of Winnipeg, Manitoba, and the Winnipeg Hydro-Electric System have reached an agreement after four months of negotiation regarding division of territory to be served by these utilities. Under this agreement, which has been foreshadowed in previous issues of the ELECTRICAL WORLD, the Winnipeg Electric Company will retire from the city of Winnipeg as a power competitor but will sell its power on a wholesale basis to the city hydro-electric plant.

The "Hydro" will turn over its contracts in all the suburbs to the Winnipeg Electric Company. The agreement means an end to the keen competition in power rates which has existed since 1912, and it also means the paying by the city of Winnipeg of several millions of dollars to the Winnipeg Electric for substations and power equipment which the city will take over. A market for the complete output of power from the Pinawa and Great Falls plants of the Winnipeg Electric Company will be assured as the city undertakes not to go ahead with any further hydro-electric developments until the output of the company's plants is fully absorbed.

New Des Moines Power Station to Be Ready Soon



THE first section of the new Des Moines (Iowa) generating station is now being tested out and will be placed in operation during August. This new generating plant, which was built by the Iowa Power & Light Company, a subsidiary of the Illinois Power & Light Corporation, was required to carry the rapidly increasing electric load of the Des Moines district, which reached a peak of over 24,000 kw. last year. Prior to the completion of this station the entire load was carried by the company's Center Street plant, which will now be retained as a reserve source of power. Owing to the limited space at the Center Street plant, which is in the heart of Des Moines, it was necessary to move out of the city, and a site on the Des Moines River at Ball's Ford, 7 miles below the city, was chosen.

The new station is being developed on the unit plan. The first unit contains a 25,000-kva. turbine and a 35,300-kva. turbine. Three additional 35,300-kva. turbines will be added in the future, making an ultimate plant capacity of 166,000 kva. While the design embodies no unusual features, it is believed that excellent economy will be obtained in operation. The plant is stoker-fired.

In addition to supplying Des Moines, the new station will serve forty-four other communities in central Iowa, including Oskaloosa, which are connected by an extensive system of transmission lines aggregating 79 miles. The design and construction of the new Des Moines station was carried out entirely by the company's engineers through the Illinois Power & Light Corporation. Only fifteen months passed from the time ground was first broken until the station was placed in operation.

Radio Conversation Carried on with Arctic Regions

The successful direct transmission and reception of messages to and from the Arctic polar area were recorded at Arlington Heights, near Chicago, Ill., on Tuesday night and early Wednesday morning of this week, when the MacMillan Arctic expedition answered a query of newspaper men from station 9XN. The expedition, located at Etah, Greenland, approximately 3,700 miles north of Chicago as the crow flies, clearly heard the message and within fifteen minutes the answer came from the Arctic, scarcely hindered by static and adverse weather conditions. Etah is approximately 12 degrees south of the Pole.

A. I. E. E. Directors Approve Use of Term "Engineman"

The following resolution, adopted at a meeting held recently by the joint conference committee of the Founder Societies, consisting of the presidents and secretaries of those societies, was presented to the board of directors of the American Institute of Electrical Engineers:

"12. *Engineer or Engineman.* — Whereas the United States Civil Service Commission has advised the Founder Societies that it has adopted the term 'engineman' in place of 'engineer' when referring to positions the duties of which are the operation, maintenance or repair of stationary or moving engines, resolved, that the presidents of the Founder Societies recommend to their respective boards that this practice be followed in the publications of the Founder Societies, and if approved by the board, that the greatest possible publicity should be given to this action."

The board of directors of the A. I. E. E. approved the above recommendation and directed that the term "engineman" be used in certain cases as indicated above in the publications of the Institute hereafter.

Industrial Lighting Prospectus Issued

A plan book of the industrial lighting activity now in progress has just been issued by the industrial lighting committee of the National Electric Light Association, of which Joseph F. Becker is chairman.

The plan as outlined is for a comprehensive campaign for increasing the industrial lighting load of the electric service companies and for stimulating the sale of industrial lighting reflectors, lamps and conduit wiring devices. The organization is similar to that used in the house-lighting activity, with a chairman in each geographic division of the N. E. L. A. and local committees which will co-operate with the division chairman and national committee.

A description of the national advertising campaign is given and advertisements suitable for local newspapers, which may be obtained from the committee, are shown. The theme of all the advertisements is the heavy cost of poor light and these will be supplemented by booklets and broadsides on better lighting, motion pictures and film projectors and industrial lighting exhibits.

Seattle Welcome Is Ready

Fine Program Prepared for Pacific Coast Meeting of A. I. E. E. in September

DISTRIBUTION, transmission, hydro-electric developments, education, research and marine applications are to be the topics of the technical papers which will be presented before the Pacific Coast convention of the American Institute of Electrical Engineers at Seattle on Tuesday to Friday, September 15 to 18. The convention will be held at the Olympic Hotel, and everything points to a well-attended and successful gathering. The technical program, subject to changes, is printed below. It has been prepared with the problems of the West especially in mind. An unusual event will be a luncheon meeting scheduled for the representatives of sections and branches on Thursday.

A number of trips of engineering and scenic interest have been scheduled, and there will be a golf tournament, dancing and ample entertainment for visiting ladies. On Wednesday afternoon the "K-B" electrically propelled boat will be on exhibition, and it will be the subject of a lecture that evening by one of the inventors, F. K. Kirsten.

Tentative Program Pacific Coast Convention A. I. E. E.

SEATTLE, SEPTEMBER 15-18, 1925

TUESDAY, SEPTEMBER 15

Morning.—Address of welcome, Dr. Henry Suzzalo, president of the University of Washington; president's address, Dr. M. I. Pupin; reports of committees, etc.

Afternoon. — Symposium on Hydro-Electric Power Development in Pacific Northwest: (a) "The Baker River Power Development," W. D. Shannon, Stone & Webster, Inc.; (b) "The Lake Cushman Dam," B. E. Torpen, Tacoma; (c) "The Oak Grove Development," H. A. Rands, Portland Electric Power Company; (d) "Water-Power Development of the Alouette-Stave-Ruskin Group of the British Columbia Electric Railway Company," E. E. Carpenter, British Columbia Electric Railway Company; (e) "Steam Power in Its Relation to the Development of Water Power," R. C. Powell, Pacific Gas & Electric Company.

Evening. — President's reception, Olympic Hotel.

WEDNESDAY, SEPTEMBER 16

Morning.—Engineering Education and Research: (a) "Some New Features and Improvements on the High-Voltage Wattmeter," J. S. Carroll, Stanford University; (b) "A Stationary Type of Laboratory Standard Wattmeter," H. V. Carpenter, Washington State College; (c) "On the Nature of Corona Loss," J. J. Hesselmeyer and J. K. Kostko, Stanford University; (d) "The Study of Ions and Electrons for Electrical Engineers," Harris J. Ryan, Stanford University; (e) "Engineering Research—A Vital Factor in Engineering Education," C. E. Magnusson, University of Washington; (f) "Relation Between Engineering Education and Engineering Research," R. W. Sorenson, California Institute of Technology; (g) "Engineering Education at the University of Pennsylvania," Harold Pender.

Afternoon.—Golf and entertainment.

Evening.—(a) "Application of Electric Propulsion to Double-Ended Ferryboats," Alexander Kennedy and F. V. Smith, General Electric Company; (b) lecture, "The K-B Propeller," F. K. Kirsten, University of Washington.

THURSDAY, SEPTEMBER 17

Morning.—Transmission Line Design and Operation: (a) "Stored Mechanical Energy in Transmission Systems," J. P. Jollyman, Pacific Gas & Electric Company; (b) "Spans Having Supports at Unequal Elevation," G. S. Smith, University of Washington; (c) "The Long Span Across the Narrows at Tacoma," A. F. Darland and J. V. Gongwer, Tacoma; (d) "220-Kv. Transmission Transients and Flashovers," R. J. C. Wood, Southern California Edison Company; (e) "The Line of Maximum Economy," E. A. Loew and F. K. Kirsten, University of Washington.

Luncheon. — Sections and branches committee meeting.

Afternoon. — 1. Transmission Line Design and Operation: (f) "Fundamental Considerations Regarding Power Limits of Transmission Systems," R. E. Doherty and H. H. Dewey, General Electric Company; (g) "Analytical Discussion of Some Factors Entering Into the Problem of Transmission-Line Stability," C. L. G. Fortescue and F. C. Nanker, Westinghouse Electric & Manufacturing Company. 2. Symposium on Distribution Practice: (a) "Distribution-Line Practice of the San Joaquin Light & Power Corporation," L. J. Moore and H. S. Minor, San Joaquin Light & Power Corporation; (b) "Improvement in Distribution Methods," S. B. Hood, Northern States Power Company.

Evening.—Dinner-dance.

FRIDAY, SEPTEMBER 18

Morning.—Symposium on Distribution Practice: (c) "The 60-Cycle Distribution System of the Commonwealth Edison Company," W. G. Kelley, Commonwealth Edison Company; (d) "A High-Voltage Distributing System," Glen Smith, Seattle Lighting Department; (e) "A Distribution System to Supply Adequately Increasing Load Densities in Residential Areas," M. T. Crawford, Puget Sound Power & Light Company; (f) "Distribution Practices in Southern California," R. E. Cunningham, Southern California Edison Company; (g) "Power Distribution and Telephone Circuits—Inductive and Physical Relations," D. I. Cone, Pacific Telephone & Telegraph Company, and H. M. Trueblood, American Telephone & Telegraph Company.

Afternoon.—Symposium on Distribution Practice: (h) "Induction from Street-Lighting Circuits — Effects on Telephone Circuits," R. G. McCurdy, American Telephone & Telegraph Company; (i) "The Radio Interference Problem and the Power Company," L. J. Corbett, Pacific Gas & Electric Company; (j) "Opportunities and Problems in the Electric Distribution System," D. K. Blake, General Electric Company; (k) "Engineering and Economic Features of Distribution Systems Supplying Increasing Load Densities," L. M. Applegate, General Electric Company, and W. Brenton, Northwestern Electric Power Company.

Briefer News

Union Gas & Electric Buys Oxford (Ohio) Municipal Plant. — The Union Gas & Electric Company of Cincinnati has purchased the municipal electric light plant at Oxford, Ohio, for $45,000. Under the franchise the company agrees to supply the town with energy at the present rate for ten years. After that time the rate may be reduced, but not increased.

Three Small Missouri Plants Merged. —The Missouri Public Service Commission has authorized the Gasconade Power Company of Hermann to purchase the power plants at Bland and Owensville. The plant at Bland is owned by W. C. Roskowske and will cost the Hermann company $11,000. The Owensville plant was bought for $25,000.

Commission Approves Calumet Acquisition.—The petition of the Calumet Gas & Electric Company, details of which were published on page 48 of the July 4 issue of the ELECTRICAL WORLD, has been approved by the Indiana Public Service Commission. This action by the commission authorizes the company to purchase the superpower system of the Calumet Power Company.

Baker River Plant Inspected.—More than one hundred representatives of banks and bonding houses in the State of Washington were the guests of the Puget Sound Power & Light Company on July 23, when an inspection trip to the new eight-million-dollar hydroelectric plant of that company at Baker River was made. Officers of almost every bank and bonding house in that state were invited. During the afternoon the visitors were shown over the plant, which is now almost completed.

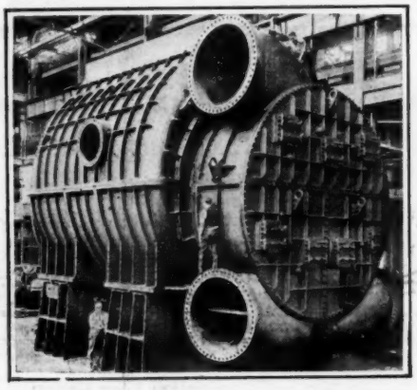
Merger of Wappingers Electric Corporation with Central Hudson Company Sought.—The Central Hudson Gas & Electric Company of Poughkeepsie, N. Y., has made application to the Public Service Commission for authority to acquire the transmission and distribution system of the Wappingers franchises of the Wappingers company Electric Corporation and to exercise at Wappingers Falls and the towns of Poughkeepsie, Wappingers, East Fishkill and La Grange. The Wappingers company joins in the petition.

Domestic Lighting Rates of Southern Public Utilities Company Less than Half What They Were.—A reduction in rates for electrical energy ranging from 3.1 cents per kilowatt-hour for industrial power to 1 cent for lighting has just been announced at Charlotte, N. C., by the Southern Public Utilities Company, a subsidiary of the Southern Power Company. The reduction becomes effective with bills payable September 1. Officials of the company declare that the reduction will effect a saving of more than $200,000 a year to the consumers. The new lighting rate is 8 cents and the power rate 6 cents. Not so very long ago the domestic rate was 15 cents.

Controversy Over Municipal Extension at Beatrice, Neb.—An appeal to the courts has been made on behalf of citizens of Beatrice, Neb., to restrain the city from levying a tax of $40,000 to extend its lighting plant. The city's action was taken on the allegation that the rate charged by the Nebraska Gas & Electric Company is too high. The company offered to lower its rate and either to buy the city's plant or to sell its own plant to the city. A lively controversy has resulted.

Indiana Executives Optimistic.—The electrical industry of Indiana is not worried over business conditions just now or in the future, judging from opinions expressed at a recent meeting in Indianapolis of the officers, executive committee and advisory committee of the Indiana Electric Light Association. Most of the executives reported consistent increases in their production and sale of energy throughout Indiana. One feature of the development is the continuing movement among manufacturers to purchase electricity instead of generating their own power. The number of private power plants is becoming smaller each year.

Great Condenser for Philadelphia's New Station Completed.—What is said to be the largest single steam condenser ever built has just been completed for the new Richmond station of the Philadelphia Electric Company by the Westinghouse Electric & Manufacturing Company. The condenser weighs about 500 tons, is 30 ft. high and has a cooling surface of 70,000 sq.ft. There are 12,734 1-in. tubes.



Federal Light & Traction May Buy Newport News Utility. — Apparently authentic reports say that the Federal Light & Traction Company of New York has arranged to acquire for cash the majority of the preferred and common stocks of the Newport News & Hampton Railway, Gas & Electric Company, which operates in Hampton, Newport News, Old Point Comfort and other Virginia cities, with headquarters in Hampton, where it has a 14,000-kva. steam generating station. J. N. Shannahan, who is prominent in the electric railway industry, is president of the Newport News & Hampton company and C. D. Porter is general manager. The transaction represents another step in the expansion of the Federal Light & Traction, which bought in April, 1923, the New Brunswick Power Company, serving the province of that name in Canada, and which has subsidiaries also in Arkansas, Missouri, New Mexico, Oklahoma, Washington, Wyoming, and Colorado.

Ottumwa Plant Goes to Iowa Southern Utilities Company. — The Iowa Southern Utilities Company, owned by the George M. Bechtel Company of Davenport, has exercised its option on the Ottumwa properties of the Northern States Power Company, owned by the Byllesby interests. The Iowa Southern Utilities announces plans for a 66,000-volt line from Ottumwa to Newton. This will "hook up" with the Des Moines Electric Company, and the Washington line will be connected in, making Ottumwa the main generating property for that territory. The Iowa Southern is supplying nearly 150 communities with power and light and has operating headquarters in Centerville, with power stations in Burlington, Wapello, Washington, Sigourney, Grinnell, Albia, Chariton, Leon and Creston.

Ford's Menominee River Enterprises. —The Ford Motor Company has petitioned the Michigan Public Utilities Commission for approval of the incorporation of the Ford Hydro-Electric Company to operate power enterprises on the Menominee River in the upper peninsula. The electric company has its home office at Madison, Wis., and its operations embrace both states. The upper peninsula development has been centered at Kingsford, just south of Iron Mountain in the center of the iron district. The Menominee River, which forms the Wisconsin-Michigan state line, flows within a few thousand feet. Construction has been going on for months.

Improvements at Janesville, Wis.— An extensive building and improvement program at Janesville, Wis., is to be launched by the Wisconsin Power & Light Company, which will install at its Monterey plant a new waterwheel unit to cost $40,000. Other units will be installed when the demand requires. A 5,000-kw. synchronous condenser will be installed in the Eastern Avenue substation at a cost of $35,000 to increase the line capacity. With high-tension transmission lines already entering the city from two directions, a third line is to be built to connect with the recently acquired properties of the Beloit Water, Gas & Electric Company. This line will have a capacity of 33,000 volts, but will be used for 13,200-volt transmission at present.

Mississippi Electrical League Elects Officers.—R. E. Bates of the Mississippi Power & Light Company, with headquarters at Jackson, has been elected president of the Mississippi Electrical League, which recently convened at Gulfport. J. D. Lanham of Greenwood and Leo Hirsch of New Orleans were elected vice-presidents, and E. E. Armstrong of the Mississippi Power Company, Meridian, secretary. Carl J. Gates of Gulfport, J. M. Field of Vicks-

burg, T. P. Stewart of Gulfport and W. R. Herstein of Memphis, Tenn., will be on the executive committee. A notable address at the meeting was made by Miss Julie Pallet of the New Orleans Public Service, Inc., in charge of public relations, who talked on "How Utility Women Can Co-operate with the State Committee."

Rates of Citizens' Company in New Orleans Increased. — The Commission Council of New Orleans has adopted without a dissenting vote an ordinance recently offered by Commissioner Hall of the Department of Public Utilities granting the Citizens' Light & Power Company, which operates in the upper sections of the city, authority to increase its rates for power and light to bring a 7½ per cent return on its present capitalization. This will place the Citizens' company on the same basis as the New Orleans Public Service, Inc. The company submitted figures to show that under its present schedule of rates, prescribed in its franchise, it had been losing money steadily since it went into business more than a decade ago. The ordinance was adopted despite protests made at public hearings.

Byllesby's New Oklahoma Purchase. —As briefly noted last week, H. M. Byllesby & Company have acquired from the Clement Studebaker interests the properties of the Consumers' Light & Power Company of Ardmore, Okla., which supply electric, natural-gas and other services in seventeen municipalities in the southern part of that state having a total population of 40,000. The towns served by the acquired properties include Ardmore, Ringling, Durant, Armstrong, Aylesworth, Madill, Bennington, Bokchito, Caddo, Blue, Mead, Kingston, Oil City, Healdton, Wilson, Woodville and Kenefic. The Consumers' Light & Power Company has steam-electric generating plants in Ardmore, Durant, Madill and Ringling with a combined capacity of around 3,000 kw. In addition to local distributing systems, the company has 75 miles of 30,000-volt high-tension transmission lines.

General Gas & Electric Acquires Towanda and North Penn Companies.— The General Gas & Electric Corporation, holding company for the W. S. Barstow properties, has acquired control of the Towanda Gas & Electric Company and the North Penn Power Company, operating in Towanda, North Towanda, Wysox, Monroe, Blossburg, Troy, Galeton and thirteen other Pennsylvania communities. The corporation already controlled the Sayre Electric Company and the Susquehanna County Light & Power Company. The Sayre transmission system is connected with the transmission system of the Binghamton (N. Y.) Light, Heat & Power Company, another subsidiary, and it is planned to connect the lines of the other three companies just named to this system and to consolidate the Pennsylvania companies.

Monticello (Iowa) and Mount Pulaski (Ill.) Plants Change Hands. — Stockholders of the Monticello (Iowa) Electric Company have disposed of their holdings to M. A. Harrison of Waverly, Iowa, and his associates, according to an announcement by Henry M. Carpenter, president of the company. Mr. Harrison will be local manager and take possession of the plant in about three months. Harry Lang is retiring manager. Clarence West and Ira Vail, for the last thirty years owners of the Mount Pulaski (Ill.) Light & Power Company, have disposed of their interests to the Illinois Public Service Company, which will take over the Monticello, Latham, Chestnut and Kenney service. Mr. West will continue to operate the local plant six months until the Illinois Public Service's high-tension line to the city is finished.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

Wisconsin Utilities Association, Electric Section—Green Bay, Wis., Sept. 4-5. J. N. Cadby, 445 Washington Bldg., Madison, Wis.

Camp Co-operation V (local leagues) —Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.— Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Pennsylvania Electric Association— Bedford Springs, Pa., Sept. 9-12. Harold A. Buch, 212 Locust St., Harrisburg, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers— Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A. —Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Benjamin Franklin Hotel, Philadelphia, Sept. 14-19. John F. Kelly, Empire Bldg., Pittsburgh.

American Institute of Electrical Engineers, Pacific Coast Section— Seattle, Sept. 15-18. F. L. Hutchinson, 33 West 39th St., New York.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 West 37th St., New York.

American Electrochemical Society— Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 1-2. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 5-9. J. W. Welsh, 292 Madison Ave., New York.

National Association of Railroad and Utilities Commissioners — Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Edison Electric Illuminating Companies — Hot Springs, Ark., Oct. 19-23. Preston S. Millar, 80th St. and East End Ave., New York.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andreucetti, 413 C. & N. W. Terminal Station, Chicago.

American Welding Society—Boston, Oct. 21-23. M. M. Kelly, 29 West 39th St., New York.

Kansas Public Service Association— Topeka, Oct. 23-24. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Southeastern Geographic Division, N. E. L. A.—Chattanooga, Tenn., Oct. 29-30. E. T. O'Connell, Alabama Power Co., Birmingham.

Worcester Company Shares Prosperity with Customers and Stockholders.— Increasing business of the Worcester (Mass.) Electric Light Company has led the directors to reduce the rates 0.5 cent per kilowatt-hour, effective September 1, and to declare an extra dividend of $2 per share payable August 10. This brings the maximum rate to 7 cents per kilowatt-hour, and according to President R. W. Rollins will save the consumers $110,000 per year. Recently the company's stock was put on a basis of $25 par, and late quotations have exceeded $125 per share. The regular dividend rate is $4 per share. Residential use of service is gaining well, appliance sales are about 20 cent ahead of last year, and industrial electric heating applications are increasing in the metal-working plants of the city.

Officers for Northwest Association.— With the appointment of section chairmen for the Northwest Electric Light and Power Association by the president, the personnel of the executive committee has been completed as follows: Lewis A. Lewis, Spokane, president; R. B. King, Boise, vice-president for Idaho; D. C. Green, Salt Lake City, vice-president for Utah; George L. Myers, Portland, vice-president for Oregon; Norwood W. Brockett, Seattle, vice-president for Washington; A. T. Schultz, Helena, vice-president for Montana; A. C. McMicken, Portland, and J. I. Colwell, Seattle, members at large; W. H. Ude, Spokane, chairman Public Relations Section; P. M. Parry, Salt Lake City, chairman Commercial Section; Z. E. Merrill, Albany, Ore., chairman Technical Section; A. J. Johnston, Portland, chairman Accounting Section; W. F. Miller, Spokane, secretary-treasurer.

Waurika (Okla.) Franchise Voted to Southwestern Light & Power Company. —The citizens of Waurika, Okla., awarded the Southwestern Light & Power Company a twenty-five-year franchise at an election last week. The vote was 200 to 33. Under the new franchise light and power rates will be lowered at once from 16½ cents to 12 cents for domestic use and from 9½ cents to 7½ and down to 3 cents for power. Sale of the Waurika plant to this company, already reported in the ELECTRICAL WORLD, was announced by the Baehr interests of Chicago about a month ago, contingent upon the franchise being voted. Construction is already under way on a high-tension line from Temple through Hastings to Waurika. It will come within 4 miles of Addington. A large substation is to be constructed in Waurika, and the present power plant will be operated as a stand-by when the line is completed, according to Earl R. Ernsberger, president and general manager.

Men of the Industry

Elwin C. Foster Resigns Presidency in Manchester

Elwin C. Foster, for the past thirteen years president of the Manchester (N. H.) Traction, Light & Power Company, recently acquired by the Middle West Utilities Company, has resigned. Mr. Foster contemplated retiring some time ago, but consented to remain at the head of the Manchester corporation until the new owners had perfected their organization. It is his intention to move to Florida, where he will reside in the future. Mr. Foster was formerly a vice-president of the New Orleans Railway & Light Company, and just prior to becoming general manager in Manchester he was connected in an advisory capacity with Sanderson & Porter, New York.

Martin J. Insull of Chicago will head the Manchester company, and J. Brodie Smith, who has served for a number of years as vice-president and general manager, has been retained in the same capacity by the Middle West company.

B. J. Sheehe has been appointed general manager in charge of operations of the Juniata Public Service Company, Altoona, Pa., and the Middleburg (Pa.) Light & Power Company.

William B. Flynn, formerly electrical engineer with Day & Zimmermann, Philadelphia, has been made construction engineer in charge of all work of the Georgia Railway & Power Company, Atlanta.

H. E. Hoadley, formerly connected with the Ohio Public Service Company at Alliance, Ohio, has been transferred to Warren as superintendent of distribution to fill the vacancy caused by the death of E. E. Hunter.

Gilbert L. Chadwick, who was associated with Hollis French and Allen Hubbard, consulting engineers, as assistant electrical engineer, has made new affiliations with the Anderson-Coffey Company, electrical contractors and engineers, also of Boston.

R. S. McCarty has been appointed manager of the advertising department of the Philadelphia Company and affiliated corporations to succeed J. V. Long, resigned. For the past year and a half Mr. McCarty has been in charge of the public relations department.

J. V. Long, vice-president of the Pittsburgh Advertising Club, has resigned his position as advertising manager of the Philadelphia Company and affiliated corporations to engage in general advertising and advertising consultant work with offices in the American State Bank Building at Sixth and Grant Streets, Pittsburgh.

Frank C. Gordon, newly appointed treasurer of the New York & Queens Electric Light & Power Company, was the guest of honor at a dinner given July 30 in the central service building of the company in Flushing, Long Island, by C. G. M. Thomas, chairman of the board of directors. There were in attendance representatives of the affiliated companies in Manhattan and executives and heads of departments of the New York & Queens Company. Mr. Thomas presented as a personal gift to Mr. Gordon a Tiffany full-jeweled gold watch in appreciation of his helpful services as his secretary. Mr. Gordon, who is not yet thirty years of age, entered the employ of the company in 1914 as a stenographer. Shortly afterward he was made assistant secretary to Mr. Thomas, and in 1916, when Mr. Thomas was made a vice-president of the Consolidated Gas Company with offices in Manhattan, Mr. Gordon became his secretary.

T. T. Parker General Manager of Kansas Electric Power

Thomas T. Parker has been appointed vice-president and general manager of the Kansas Electric Power Company, with offices in Lawrence, to succeed the late Donald O. Vaughn. Mr. Parker is one of the veterans of the Albert Emanuel Company, his first connection with that organization dating back to 1914, when he became power solicitor in the commercial department of the Kansas Electric Power Company's Parsons division. Subsequently he was made commercial manager there. Later he entered the service of the Union City (Ind.) Electric Company as manager, and after an association of three years with that utility he rejoined the Kansas Electric Power Company as manager of the Emporia division. Mr. Parker's next appointment was to the managership of the Dubuque (Iowa) Electric Company, where he remained until the property was purchased last year from the Albert Emanuel Company by the Utilities Power & Light Corporation.

T. T. PARKER

Sumner C. Palmer, Jr., who has been in charge of the investment department of the Western States Gas & Electric Company in the Richmond district for the past two years, has recently been placed in charge of the investment department of the Mountain States Power Company. Both these companies are Byllesby properties. The transfer is a promotion for Mr. Palmer, placing him in charge of the investment department of the company in three states.

C. J. Harvin, formerly connected with the betterment division of Stone & Webster, has been appointed superintendent of light and power of the Baton Rouge (La.) Electric Company. The Baton Rouge utility is under the executive management of Stone & Webster.

Robert A. Riley has been appointed general sales manager of the Southeastern division of the Western Electric Company, succeeding C. D. Cabaniss, resigned. Mr. Riley, who is now manager of the New Orleans branch of the company, will assume his new duties August 10.

Wilmer P. Holben, formerly assistant distribution engineer with the Pennsylvania Power & Light Company, Allentown, Pa., has resigned to become senior engineer in the distribution and transmission section of the engineering department of the Philadelphia Company, Pittsburgh.

H. A. Triplett, who has been affiliated with the Duquesne Light Company of Pittsburgh for the past four years as assistant electrical engineer in charge of transmission and distribution, has resigned to enter the employ of the Schweitzer & Conrad Company, Inc., Chicago.

J. W. Kelly, assistant treasurer of the Keokuk (Iowa) Electric Company, has been transferred to the Baton Rouge (La.) Electric Company in the same capacity. Stone & Webster operate the two companies. **B. H. Moore,** who has been identified with Stone & Webster at Keokuk for the past three years, has been selected to succeed Mr. Kelly.

Dugald C. Jackson, Jr., has been placed in charge of the department of mechanical and electrical engineering at the Speed Scientific School, a new school of the University of Louisiana. For the past two years he has been assistant professor in charge of electrical engineering at Trinity College, Duke University, Durham, N. C.

T. F. Keefe, who has been in charge of the public relations activities of the Wisconsin Power & Light Company for the past two years, prior to which he was in charge of the company's electric properties at Baraboo, Mineral Point, Sheboygan and other cities, has been named manager to take charge of the properties of the Beloit Water, Gas & Electric Company, which were recently taken over by the Northwest Utilities Company.

J. Ledlie Hees of Gloversville, N. Y., has resigned as president of the Adirondack Power & Light Corporation, the position he has held since the formation of the corporation in 1920. Mr. Hees has been prominently connected with public utilities of the Mohawk Valley, in New York State, since 1892. In 1919 the Edison Electric Light & Power Company of Amsterdam, which up to that time had been owned by railway interests with which Mr. Hees was affiliated, was merged into the Mohawk Edison Company, Inc., as one of the early steps toward forming the Adirondack Power & Light Corporation. When in March, 1920, the Mohawk

Edison Company, Inc., changed its name to the Adirondack Power & Light Corporation and a few months later it and the Adirondack Electric Power Corporation were united and became the present Adirondack Power & Light Corporation Mr. Hees was chosen as its first president.

T. H. Sherrard, president of the Laurentian Hydro-Electric, Limited, has been elected a director of the Quebec Southern Power Corporation.

A. H. Drummond has resigned his position as division inspector in the transmission and distribution department of the Westchester Lighting Company, Yonkers, N. Y., to become assistant to the distribution engineer of the Pennsylvania Power & Light Company, Allentown, Pa.

E. O. Rugless, with the Bloomington and Normal (Ill.) division of the Illinois Light & Power Corporation, and for nine years auditor, has been made chief of the investment department in Bloomington, Ill., to succeed E. F. Snyder, transferred to Galesburg, Ill., in that capacity.

Fred T. Ealand has been appointed manager of the appliance sales department of the Oklahoma Gas & Electric Company system. Mr. Ealand has had wide experience in merchandising appliances through his former connection with the General Electric Company.

Major R. W. Chandler, manager of truck sales, Yale & Towne Manufacturing Company, Stamford, Conn., has resigned to become assistant chief engineer of the Philadelphia Company, Pittsburgh, effective August 1. He has been succeeded at Stamford by **J. C. Morgan,** formerly manager of hoisting equipment sales, who has been appointed manager of material-handling equipment sales. The title of manager of hoisting equipment sales has been discontinued. Major Chandler was for some time attached to the research staff of the Yale & Towne company, and Mr. Morgan is well known in the electric industrial truck and tractor field, having formerly been at the head of that branch of the company's sales activities.

Obituary

Harry W. Reilly, assistant to the general manager in charge of operation of the Oklahoma Gas & Electric Company, died in Milwaukee, Wis., July 23. Mr. Reilly was born in Albany, N. Y., in 1875 and was graduated from the University of Wisconsin in electrical engineering in 1897. After a short connection with the J. G. White Company he entered the service of the Brooklyn Rapid Transit Company, later returning to the White organization, where he remained until 1910. During this period Mr. Reilly had a varied experience, his profession taking him to many points in the United States, Mexico, Porto Rico and Cuba. He became identified with the Byllesby Engineering & Management Corporation in 1910 and with the Oklahoma Gas & Electric Company in 1917, going to Oklahoma City from San Diego, Cal., where he was in charge of engineering and valuation work. It was in 1920 that Mr. Reilly was named assistant to the general manager in charge of operation.

Herbert M. Beechinor, who had been for some time with the Electrical Testing Laboratories, New York, in the capacity of assistant engineer in cable inspection, died at the Mount Vernon Hospital July 20 after a brief illness. Mr. Beechinor spent five and a half years in the testing department of the New York Edison Company after being graduated from the University of Michigan in 1906. He had been affiliated with the Duquesne Light Company at Pittsburgh and with the American Electric Fuse Company at Cleveland before identifying himself with the Electrical Testing Laboratories.

Commission Rulings

Pennsylvania Commission Upholds Utility's Right to Inspect Installations.—In the case of Thompson vs. Penn Public Service Corporation the Pennsylvania Public Service Commission sustained the reasonableness of a company ruling relating to a company inspection of all new installations. The commission said: "It is evident that it is not only reasonable but necessary that an electric light and power company should require evidence that wiring and equipment in buildings to be connected with its lines are of a safe kind and properly installed. A failure to do so might easily result in serious property damage, personal injuries or loss of life, for which the public service company might, under certain circumstances, be held liable. Damage might also be caused to the utility's system, with resulting interruption in service. The weight of evidence is to the effect that the specifications and regulations contained in the National Electrical Code, so far as they affect this case, are reasonable and proper. The fact that respondent's Rule 2 incorporates the specifications of the code by reference, instead of setting them forth at length, does not, *ipso facto*, make the rule unreasonable."

North Dakota Commission Without Authority to Authorize Abandonment of Utility Service.—The North Dakota Board of Railroad Commissioners, in a case concerning the Otter Tail Power Company of Fergus Falls, Minn., held that, under the state public utilities act, the commission had full authority to change rates fixed by a franchise or private contract entered into prior to the passage of the act, but that there was no passage in the law which gave the commission the right to authorize complete abandonment of any public utility service voluntarily established by the utility. The commission said: "It seems clear that a company having a franchise to serve municipalities with light, power and heat cannot abandon any part of it merely because it does not pay, unless the Legislature has authorized such action or vested in somebody the right to authorize the abandonment. . . . . It is generally held that if the franchise under which a utility is operating is merely permissive, the utility may withdraw from the service; but where the franchise is obligatory the service cannot be withdrawn unless the property as a whole is unprofitable and cannot be made to earn a return by providing increased rates. Even under the latter condition it would appear that somebody must sanction the abandonment of service."

Principle that Amount of Securities Does Not Affect Rate-Base Value Once More Affirmed.—In authorizing the sale by I. A. Van Dyke of the water and electric utilities of Miami City, Ariz., to the newly formed Miami City Power & Water Company the Arizona Corporation Commission stated once more that the amount of bonds and stock issued by a utility could not be considered by a commission in determining a property value on which to base rates. The commission authorized the purchase and authorized the issue of bonds and stock which the new company desired, but warned that the amount of the securities would have no evidential weight in determining future rate bases. This utility has been an adjunct of a real estate company, and a rate case in which it was involved was reviewed June 27, page 1422.

Recent Court Decisions

Police Power of State Permits Fixing of Public Utility Rates Without Regard to Private Contracts.—In Washington University vs. Public Service Commission of Missouri the Supreme Court of Missouri held that the fixing of a rate for a public commodity falls under the police power of a state and that therefore, when the power company took over the university's private plant, the Public Service Commission had full power to ignore private contracts made between the university and the power company and to fix such rates for steam heating and electric service as it believed equitable. The university claimed that since the company furnished steam heat to only a few customers it was not a public utility in giving such service and hence such business was not subject to commission regulation. It further contended that the commission could not ignore the contracts made between the company and the university. The court held, however, that the commission was in the best position to determine whether the company's steam-heating service was a utility service under its charter, and from evidence submitted it upheld the commission's ruling. The court also held that under the state constitution the police power of the state, under which rates may be regulated for all public services for the good of both the public and the utility owners, could not be abridged by a private contract. (272 S.W. 971)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Over-Extension of Credit

Some Conditions Among Contractor-Dealers—From a Recent Paper Before the Pacific Coast Jobbers

BY J. L. KLINE
Electric Light & Fixture Company, Los Angeles, Cal.

CREDIT men of the electrical industry do not give sufficient time to the classification of the contractor-dealer. We are doing business with various classes of contractors. We have the class that is well established, doing a successful business, and discounting his bills. We have a second class whose assets and liabilities are about equal, who does not take advantage of cash discounts, but who is, in normal times, a satisfactory "risk." We have a third class that is constantly requiring financial aid from the jobber, and to whom none of us safely can extend credit. Were I a contractor, and had a policy of my own, I would not be keen to do business with a jobber who did not have a definite policy to protect me.

Credit men are prone to extend credit to "risks"—on which is placed a credit limit of from $50 to $100—and this clase of "risks" is the one that causes trouble. It is true that not every contractor or dealer has a thousand dollars or more with which to start, and that small beginners have worked up to splendid accounts, but nowadays such examples are few and far between.

To prove this assertion I have made a study of the electrical permits as issued by the electrical department of the city of Los Angeles, for the month of March, and the results of same, I think, are good food for thought.

I have divided these into two classes —one consists of 115 contractors, and the records show that during the month their wiring outlets ranged from two to and not exceeding fifty. The total number of wiring outlets for this class was 3,387, for which 645 permits were issued. This gives an average of approximately twenty-seven outlets for the month for each contractor, or 5.6 permits for each contractor. This proves conclusively that not one of these 115, were he getting the highest possible prices for his labor and material, could have even made wages, and each and every one of these would prove a total loss as a credit "risk."

Class two consists of eighty-five contractors, whose average of wiring outlets runs from 200 to 1,000. The number of wiring outlets to this class was 32,065, the number of permits 1,727. This gives an average of 877 outlets and twenty permits to each contractor. This class I would consider a desirable credit "risk."

In recent conversation with some of the credit men of the Los Angeles jobbers, in reference to accounts who are owing ninety days or over, I learned that we are all carrying quite a few of these, and the result of this conversation shows clearly that we are in the banking business. But stop—the banker never makes a loan unless he receives some kind of security and the loan draws interest; but alas, the jobber has not had the nerve to demand either. Another disclosure of this conversation was that the larger portion of the money owed was by the contractor-dealer who is allowed to scatter his purchases broadcast, and undoubtedly much of this sum will eventually be lost.

It is serious, in my opinion, that so few jobber executives understand the real nature of credit, and are inclined to class the workers in credit as mere cogs in a wheel, performing nothing more than mechanical service. Yet, if there ever was a line of work to which the term mechanics did not apply, it is credit. I think that the secret of remedying the situation lies in further work along the lines of credit organization. My own suggestions for the reduction of risky credit are as follows:

1. Terms of sale should be thirty days or the tenth of the following month, and not sixty days.

2. An interest charge be made on all accounts that are thirty days past due. Essentially this is a banking problem.

3. Each jobber should have a definite and positive policy as to the time limit of credit, and if this policy is announced he should enforce it strictly.

4. Credit men should give great thought to individuals who are seeking credit, and who at that time are heavily in debt to their competitors, and should be extremely cautious in extending them credit, for this not only places accounts with others in jeopardy, but is in itself a very poor credit "risk."

5. Credit associations should make monthly reports showing percentages of outstanding accounts.

For Centralized Purchase and Manufacture

Massachusetts Department of Public Utilities Hands Down Telephone Decision that Bears Upon Group Management

IN A DECISION last week granting the New England Telephone & Telegraph Company a 19 per cent increase in rates, the Massachusetts Department of Public Utilities discussed at some length the practice of centralized manufacturing and purchasing as conducted for the associated companies of the Bell system by the American Telephone & Telegraph Company and the Western Electric Company, Inc. These relations had been severely attacked by the New England company's opponents. In view of the spread of holding-company management in this country, the following comments of the commission in the telephone decision will be of interest to manufacturers, jobbers and central-station group managements in particular:

"The American Telephone & Telegraph Company owns 58 per cent of the capital stock of the New England Telephone & Telegraph Company and with but two exceptions a controlling interest in each and all of the other operating companies which form the Bell system.

"It operates too—and this is perhaps its major function—as a comprehensive enterprise for the development of the telephone art. It appears that it employs over 3,000 technically trained men—scientists, engineers, mechanics and others—in research work. The services of this force are available to the members of the Bell system, known as 'Associated Companies,' for consultation and advice in matters pertaining to the industry.

"It assists these companies, also, in financing, accounting and other directions. The Bell System, as we view it, constitutes in substance a co-operative enterprise, the theory being to centralize all these activities under one head and not have them carried on by each individual company.

"It is true in our opinion, as has been contended, that the New England Telephone & Telegraph Company acts as a component part of this system and in effect is an agency of the American company. We are not, however, satisfied that this is detrimental to the interests of the New England public.

"The American company charges each of the companies of the Bell System, including the New England Telephone & Telegraph Company, in return for these services and for the use of certain telephone instruments — the receiver, transmitter and induction coil— 4½ per cent of their gross revenues. Perhaps a better basis might have been adopted, as, for example, a certain charge per telephone station, but we do not think that that is the problem which faces us. We must take the facts and the law as we find them.

VALUE OF THE CONTRACT

"The Supreme Court of the United States, in the Southwestern Bell Telephone rate case (262 U. S. 276) overruled the Missouri regulatory commission, which reduced by one-half the compensation paid by that company to the American company, and stated that it was not for a public utility commission to make or remake such a contract, but merely to determine whether it had been made in good faith or not.

"With this in mind we have considered the value of this contract from what appear to us the two most im-

portant viewpoints. We are of the opinion, upon the evidence before us, first, that the American company furnishes this service and these instruments to the various companies of the Bell System at little above cost, and, second, that what the New England Telephone & Telegraph Company receives from the American company is worth what it pays therefor under this so-called license contract. It is perhaps but natural to look with suspicion upon contracts between companies with such intercorporate relations, but we are constrained to say that we cannot find, upon the evidence, that this 4½ per cent license contract was either a dishonest or an imprudent one for the New England Telephone & Telegraph Company.

"We have discussed this arrangement as a contract to be dealt with upon the principles laid down in the cases above referred to. We entertain grave doubt, however, whether such an arrangement between such parties constitutes a strict contract. We think that it is merely a method by which the American company arranges for the payment of the services rendered and the use of the instruments furnished its local companies.

AMERICAN COMPANY'S PROPERTY

"In the last analysis, in our judgment, it makes very little difference in cost of telephone service to the public how this burden is borne, provided, first, that it is done equitably and proportionately among the associate companies; second, that the funds received by the American company from the associate companies for these services and the use of these instruments are used solely to defray these expenses and to pay no more than their fair proportion toward a reasonable return upon the capital employed by the American company in its business, and, third, that all the capital of the American company is devoted to the telephone industry.

"From the evidence all these appear to be true, and we are also satisfied that the property of the American company is worth the face value of its capital stock and other outstanding securities. It may be that upon some other facts at some other time we might reach a different conclusion, but on the actual testimony in this hearing as it stands we can reach no other decision. . . .

WESTERN ELECTRIC COMPANY

"The American company owns practically all of the stock of the Western Electric Company. The Western Electric Company is the manufacturing and purchasing company of the Bell System. It occupies that field in the cooperative enterprise.

"We believe that the New England Telephone & Telegraph Company, by acquiring supplies from the Western Electric Company, using its warehouses and its services as purchasing agent, obtains what it requires cheaper, on the whole, than it could elsewhere.

"This might not, perhaps, be true if the telephone industry were differently organized. But, taking it as it is, we feel that this arrangement with the Western Electric Company is not detrimental to the New England public. Conditions may, of course, change, and upon different evidence we might reach a different conclusion, but on the actual testimony in this case we think no other result can properly be reached."

Manufacturer and Consumer

Sustained Contacts Beneficial—A Case Cited Indicates the Value of Sharing Operating Experiences

MANUFACTURERS and users of electrical apparatus and supplies are more and more coming to realize the value of sustained contacts with one another in connection with the field service of all sorts of products. From the earliest days of the central-station industry, both manufacturer and user have been handicapped by a certain immobility due to their respective localized tasks. The former has been obliged to concentrate upon factory production, and the latter has been under a similar limitation with respect to the production and sale of energy in a specified district.

Until later days there often has been a dearth of field service coverage on the part of the manufacturer, resulting in a sort of lost motion between the designer at the factory and the operating engineer of the purchaser. There has been excellent sales coverage, and of course there have been countless conferences between the two classes of industry personnel. Intimate understanding of commodity production problems, however, has naturally devolved upon the manufacturer, and the user on his part has "lived with" the operating problem.

Not long ago an instance arose of co-operation between a central-station company and a manufacturer which has borne good fruit, and which indicates the value of intimately sharing operating experience with the man at the factory. The operating company had conducted an extended investigation of its watt-hour meter bearings, and found that its maintenance and inspection routine could be much improved. This new routine included the removal of all major maintenance work on meter bearings from the customer's installation to the central-station meter laboratory. Under the old conditions, it was practically necessary to dismantle the meter to remove the pivot. A new pivot puller was designed which allowed the meter tester in the field to change pivots on this make of meter in a few seconds without dismantling it. This pivot puller has since been adopted by the manufacturer and has been made available to any of his customers.

As the investigation progressed it became necessary to purchase new pivots from the factory in considerable numbers to replace defective ones taken from long service. Defective jewels also had to be sent back to the manufacturing plant for recupping and repolishing. In inspecting this new material it was found, in conference with the factory engineers, that there was a worth-while opportunity for improvement in factory methods to raise the standards of the product to a still higher plane. As a result of co-operation between the customer and the manufacturer the following betterments have been achieved in this line:

First, the factory routine on meter pivots for roughing out, grinding, polishing and inspection has been improved so that pivots are no longer allowed to accumulate traces of rust between operations in the factory or during shipment or storage. The percentage of defective pivots going as far as inspection has been greatly reduced despite the fact that the inspection has been made much more rigid than formerly.

Second, a new pivot was designed and put into use which is far better than the former and which, incidentally, can be manufactured at much lower cost. Inspection is now a simple and sure operation, and the manufacturing burden of culling defective work from the finished article is now eliminated.

Third, after some study a scheme was devised to protect the pivots from rusting and from accumulating dirt or abrasive material during storage or shipment. Now each pivot of this make is inspected, oiled and sealed in an individual capsule under a microscope, the capsule protecting it until used.

Fourth, jewels are now handled in the factory with the care given in the user's laboratory, and are kept rigidly clean in their routing, storage and shipment.

KIND OF TEAM PLAY THAT COUNTS

This kind of team play is a gain to the whole industry, and well repays the cost and time involved in the co-operation of purchaser and manufacturer, which includes personal visits and calls for open-mindedness on both sides. It is a good instance of a class of activities that progressive men widely approve, and while far from unique in these days of increased mobility in the industry, deserves emphasis as a citation of a beneficial "tie-in" between buyer and seller.

Tennessee Tax on Electric Goods Held Illegal

The section of Tennessee's special-privilege license law affecting dealers in electric goods was relegated to the scrap heap of worthless legislation by Chancellor David de Haven in an opinion handed down in Memphis on July 27.

The handling of flashlamps and electric light globes by drug stores is a part of the drug-store business and is therefore subject to no special tax, the chancellor holds. The ruling will also affect groceries, department and furniture stores and others who handle electrical goods as a part of their regular business.

The act as passed by the Legislature imposed a tax of $150—$50 each for state, county and city—on all dealers in electric goods. This was in addition to the regular license and ad valorem taxes. Electric light and power companies and radio dealers were exempted.

Ed V. Sheeley, local druggist, refused to pay the special tax on the ground that the handling of flashlamps and globes has been a part of the drug store business for twenty years.

Business Conditions

THERE is a strong tone to the electrical market again this week, except among the jobbers of the New York district, who are right now experiencing a summer slump, and in less degree this is true of the Middle Western wholesale business. News from New England, the Southeastern States and the Pacific Coast section records active buying, and New York and Chicago manufacturers are busy and expect a continued demand. Reports just published by two of the larger electrical manufacturers for the second quarter of the year show sizable gains over 1924. July failures were announced as the smallest of any month of the current year. Meanwhile the copper and lead markets have risen sharply, and this has been accompanied by an advance in wire approximating 5 per cent. Car loadings have again topped the million mark. There is general optimism on the agricultural outlook, although the continued drought in the South is threatening and is already embarrassing the Southeastern water-power companies. However, the electrical market there continues very strong and active.

Building is still in good volume in New England, and wire, insulation, pipe and wiring devices are selling well, also central-station supplies, notably fiber conduit, poles, cross-arms and line hardware. Appliances are slow. Fixtures are active. In the New York district contractors are buying from hand to mouth and jobbers are quiet with stocks low. Manufacturers report steady business to industrials and utilities, including one order for 53,000 suspension insulators. Wire has been stimulated by a 5 per cent advance. Radio is picking up, and R. C. A. tubes were reduced to $2.50. Jobbers in the Southeast are doing good business, the best markets being in Florida and Alabama. Line materials, transformers, meters, motors and street-lighting equipment are strong. In the Middle West the wholesale market is steady but in small volume. Pole-line hardware and specialties advanced slightly. Utilities are buying actively for maintenance. Clothes washers have sold well. Sales to power companies, industrial firms and contractors are excellent on the Pacific Coast. Important orders for ranges and line material were booked this week. Appliances are quiet.

Material-Handling Equipment Sales on Increase

SALES of material-handling equipment are increasing steadily, say manufacturers, but with no indications of a boom, since industry is becoming more completely educated in connection with the use of such equipment. It is believed that it is not merely a question now of educating industry to the savings which can be effected by the use of such equipment but of providing the best type of equipment for the particular requirements. Deliveries are fairly good, despite the pressure constantly exerted by purchasers for immediate delivery. As far as prices are concerned, there is a tremendous downward pressure being exerted all along the line, but aside from variations in the price of raw materials there has not been any substantial change in the past year and present prices are liable to remain as they are.

Sales of Vacuum Cleaners Are Holding Up Well

MANUFACTURERS of vacuum cleaners report that sales are holding up well as compared with last year. The demand is said to be well diversified as to geographical location. One company states: "We have every reason to feel satisfied with our own experiences, finding our business to be holding up very nicely. During the close of 1924 we found the most active demand of our business career." Sales by one manufacturer are reported as being 10 per cent ahead of last year, and the outlook is very good. Collections are in very good condition and material is plentiful.

No difficulty is being experienced in making prompt deliveries, manufacturing facilities being well in advance of any possible demand, and stocks at various points are ample. In more than one instance during the last year manufacturing facilities were increased. Prices are firm and there is no indication of a change. It is believed, however, that better values are being offered as, from time to time, substantial improvements and refinements are being added with no increase in cost.

Delinquent Electrical Accounts Decrease in June

THE average value of delinquent accounts reported to the National Electric Credit Association in June, 1925, decreased in the Central, New York and Philadelphia territories and increased in the New England and Pacific Coast sections. The figures are as follows:

DELINQUENT ACCOUNTS IN JUNE

Branch and Month		Number of Accounts Reported	Total Amount	Average Amount
Central Division:				
May,	1924	957	$110,184.35	$115.13
May,	1925	1,066	125,851.18	118.06
June,	1924	889	108,723.48	122.30
June,	1925	900	102,366.77	113.74
New York:				
May,	1924	366	51,725.00	141.00
May,	1925	338	55,157.00	163.00
June,	1924	336	49,433.00	147.00
June,	1925	415	53,414.00	129.00
Philadelphia:				
May,	1924	327	32,961.99	100.80
May,	1925	227	32,736.17	144.21
June,	1924	248	28,063.46	113.16
June,	1925	259	36,497.91	140.92
New England:				
May,	1924	70	6,883.85	98.34
May,	1925	116	12,981.98	111.91
June,	1924	88	7,021.00	79.78
June,	1925	87	15,310.35	175.74
Pacific Coast:				
May,	1924	28	3,180.00	113.57
May,	1925	27	2,101.04	77.82
June,	1924	22	3,877.39	176.25
June,	1925	17	2,193.62	129.04

Non-Ferrous Metals Advance in Active Market

THERE has been a renewal of buying activity in the non-ferrous-metals market in the last week, with a further advance in the prices of copper, lead and zinc. Although there is ample for immediate requirements, the supplies of all these metals are not overlarge. Metal consumers are experiencing better business than they have anticipated at this season.

Copper is selling more freely than at any time since the week of June 17, and prices have risen sharply. On Thursday, Friday and Saturday the price ran 14⅝ cents delivered. On Monday and Tuesday spot copper sold at 14⅝, and the bulk of the business was at 14¼ for September-October delivery. On Wednesday the price stood at 14⅝ cents. It is predicted that 15 cents will be reached before September 1. The foreign market has continued quiet.

NEW YORK METAL MARKET PRICES

	July 29, 1925 Cents per Pound	Aug. 5, 1925 Cents per Pound
Copper, electrolytic	14⅛	14⅛
Lead, Am. S. & R. price	8.20	8⅛
Antimony	17½	17½
Nickel, ingot	34	33–34
Zinc, spot	7.67½	7.90–7.92
Tin, Straits	58¼	59⅜
Aluminum, 99 per cent	27	27

Base copper price July 29, 1925, 16½ cents.

The American Smelting & Refining Company advanced its price for New York lead from 8.26 to 8.30 on Thursday, July 30, to 8.50 on Monday, and to 8.75 on Wednesday, August 5. There is not enough lead at present to take care of all legitimate inquiries, although producers are selling all their intake and not holding up any supplies for future higher prices. So far as is known, however, no consumer has been forced to curtail because of shortage.

Market Continues Active in Southeast—Drought Still Lasts

A GENERAL improvement in business activities throughout the Southeast is reported by all jobbers, and one Atlanta house had July billings in excess of any month in the company's history. While the territory as a whole is looking up, Florida and Alabama continue the most active states. Orders are for all lines of electrical equipment, with sales of distribution and high-tension-line construction materials, distribution transformers, meters and street-lighting equipment particularly good. Orders from Florida for creosoted pine poles totaling $30,000 and for "white way" equipment totaling $12,000 were recorded. Industrial motors ranging from 5 hp. to 200 hp. are more active than for some time past. Good orders were received from New Orleans and Birmingham.

Radio seems to have taken a spurt, and the leading radio jobber in Atlanta reports his July sales volume ahead of the same month last year, with the fall outlook excellent. There is an awakened interest on the part of central stations in electric signs.

No break-up in the long drought has

been realized, and crops throughout north Georgia are severely hit. Unless relief is immediately experienced, the damage will be reflected in slower trade activities in the fall. Hydro-electric companies are all in need of water.

Lighting Contracts Active in New England

HEAVY buying of wire and insulation is reported from the New England States this week, due in a great measure to building requirements and also in part to the rise in price of copper and rubber. Sockets, small switches and pipe have been quite active, and there is a steady demand for both residential and commercial types of fixtures.

Several houses in Rhode Island show a good volume of sales of fixtures. In one case 20 per cent increase to date over last year is recorded, in another case 15 per cent increase, and, in addition, three concerns report material gains. Schools and homes are actively in the market.

There has been good business in central-station supplies, with fiber conduit, poles, cross-arms and line hardware in steady movement. Power units are receiving a little attention, and small motors continue to hold up well.

Domestic electric appliance sales have dropped off somewhat. Two large power equipment contracts have received bids, and awards are pending. The town of Clinton is planning to erect fifty ornamental street lamps.

Nine electric companies outside of Boston report a net gain in energy sales for the first six months of the year of from 4.17 to 83.66 per cent in kilowatt-hours. During this same period the Boston Edison company records its gain in output at from 18 to 20 per cent as compared with the corresponding period of last year.

Next Few Months Are Promising in Middle West

THE business outlook in the Middle West for the next few months appears very promising. The farmer is in a better position financially and will soon be buying equipment, which means that business in general will benefit in this agricultural territory. Meanwhile steady buying of maintenance materials by the various utility companies helps to increase the general volume of business. There has been a sustained market for most commodities, without any marked demand for any particular item. A manufacturer of electric vehicles reports having sold one central-station company seven electric trucks, and a manufacturer of outdoor substation equipment received an order for 500 6,600-volt and 100 13,200-volt busbar supports this week.

Jobbers' sales have been steady. The volume of business is lacking owing to summer conditions, but there is a good demand for electric washers, one jobber placing an order this week for 500 machines. Prices remain firm, with an upward tendency. Pole-line hardware and specialty prices advanced a trifle, revisions being issued on one manufacturer's entire line. Code-wire prices advanced approximately 7 per cent and No. 14 two-conductor "BX" advanced 5 per cent. The Radio Corporation reduced the list price of popular-type radio tubes to $2.50 each, effective August 1.

New York Quiet—Wire and Line Material Strongest

ELECTRICAL jobbers in the New York district are in the August doldrums and business is very light—quieter probably than last week. Contractors are buying from hand to mouth, and with the large number of men absent on vacations, the wholesale market is not expected to improve materially before September. Wire advanced approximately 5 per cent, and manufacturers report the market stimulated, particularly by sales to the radio industry. The trend of the wire market is expected to be up. The price of radio tubes was reduced from $3 to $2.50 on the popular sizes. Sales of materials and equipment to the industrial market are steady and in some lines 40 to 50 per cent better than last year. Building activity seems to be increasing steadily. Architects' offices are exceedingly busy. Sales of line material for power-company construction continue strong, manufacturers say. One order for 53,000 suspension insulators was received from Philadelphia this week. Motor business holds fair with a diversified demand. Jobbers' stocks are generally very low, and more active buying is anticipated within the next few weeks in preparation for the fall seasonal awakening.

Active Market on Pacific Coast—Rate Reduction in Northwest

ELECTRICAL contracting, power-company and industrial business is excellent on the Pacific Coast, with lateral and feeder-line construction active. The northern and central California range campaign sold 450 ranges during July, and orders for six carloads of ranges have already been placed or are pending. Railroad business is temporarily quiet, the most noteworthy order being for 10,000 pieces of pole-line hardware. Appliance business is rather poor. Local stocks of staple lines are somewhat high, perhaps because of preoccupation with radio and other specialties, and intensive selling efforts are planned to move them. Credit conditions are excellent, and collections are now below a fifty-day average. A two-carload lead-cable inquiry for Manila is reported.

In the Northwest the Puget Sound Power & Light Company has announced a minimum reduction of ½ cent a kilowatt, effective September 1, changing the rate structures on new properties taken over in the past two years. All tariffs in western Washington, affecting both commercial and residence lighting, are reduced. The reduction in some towns amounts to as much as 2½ per cent. The Seattle Board of Public Works has awarded contracts for furnishing 180,000 lb. of weatherproof copper wire on bids approximating $31,185 and opened bids for furnishing 600 cedar poles and 15,000 standard locust or eucalyptus pins.

Activities of the Trade

Fairbanks-Morse Shows Gain on Quarter

Fairbanks, Morse & Company report for quarter ended June 30 a total of orders received 34 per cent in excess of the aggregate for the same period of 1924 and a substantial increase in unfilled orders on the books. Gross revenue was $2,829,779, against $2,094,116 last year, and net income $898,029, which was an increase of $339,922 over the total net of the second quarter of 1924. This figure is taken after depreciation, federal taxes and pension fund are deducted and is equivalent to $2.03 a share on the 368,977 shares of common stock outstanding, compared with $1.28 last year.

Williams Oil-O-Matic Corporation Increasing Plant Capacity

Construction is now under way on the second unit of the Williams Oil-O-Matic Heating Corporation, Bloomington, Ill. This unit will be 40 per cent larger than the first plant and production will be doubled immediately on its completion. "We have more than doubled our floor space in the last year," said C. V. Williams, president, "but we are 10,000 orders behind right now, owing to our inability to produce at least 300 per day. The company making our special motors is now moving its factory to our own property to keep pace with us.

"We have close to 1,200 dealers now in practically every important city and town in the United States and Canada," Mr. Williams further stated. "Our export business also is beginning to assume big proportions. The Williams Institute of Heat Research, which is our school for training dealers, salesmen and service men, is now conducting special summer courses in several cities on the Pacific and Atlantic coasts and in Canada.

Allis-Chalmers Reports Increase for Second Quarter

The Allis-Chalmers Manufacturing Company of Milwaukee reports for the second quarter of 1925 billings of $7,042,750 and net profits of $830,022, which is an increase over the same period of last year of $132,484, or 1.9 per cent, in billings and $73,599, or 9.7 per cent, in net profits. Deducting $288,702 for the quarter's dividend on the preferred stock leaves a balance of $541,319 for the common, which is equivalent to $2.10 per share, compared with $1.81 per share in the second quarter of 1924. The net earnings for the six months period to June 30, 1925, amount to $4.27 per share on the common as compared with $3.91 for the similar period in 1924. The bookings

for the current quarter aggregated $6,564,806, compared with $7,073,486 for the same period a year ago, a decrease of $508,679. Bookings, however, for the first six months of 1925 amount to $13,718,405, contrasted with $12,768,841 in the first half of 1924, an increase of $949,564. The net quick assets as of June 30, 1925, aggregate $26,234,305, compared with $24,915,159 at the close of 1924, an increase of $1,319,145 over the six-month period.

General Electric Gets Contracts for Large Power-Plant Units

The Western United Gas & Electric Company, Aurora, Ill., has awarded to the General Electric Company a contract for a 25,000-kva., 13,200-volt turbo-generator unit, operating under 300 lb. per square inch pressure at a temperature of 200 deg.

The International General Electric Company has received a contract for an 1,875 kva., 60-cycle turbo-generator unit, to be delivered in Porto Rico.

Westinghouse Sets Up New Engineering Division

The Westinghouse Electric & Manufacturing Company has established in its San Francisco office an engineering division to pass upon the engineering features of specifications and negotiations as well as to assist customers in their engineering work. The division will cover the complete field of engineering as far as the various products of the company are concerned.

A. W. Copley, for the last five years general engineer for the Pacific Coast territory of the company, has been named manager of the new division. Mr. Copley has been with the company for twenty-two years and during the last few years has been dealing particularly with hydro-electric developments. In addition to his duties as manager of the new division he will retain his position as general engineer for the San Francisco, Los Angeles and Denver offices.

The other members of the new division are F. L. Boissonnault, control engineer; P. B. Garrett, automatic control engineer, and P. B. Plass, motor engineer. These men have had several years' experience with the company at its East Pittsburgh works. Mr. Boissonnault and Mr. Garrett during the past few years have been engaged in engineering work with the San Francisco office.

Roller-Smith Appoints Agent in Knoxville

The Roller-Smith Company, 233 Broadway, New York, manufacturer of measuring instruments and circuit breakers, announces the appointment of the Tennessee Engineering & Sales Company, 510 Burwell Building, Knoxville, as its agent in that part of Tennessee and Kentucky within a working radius of the city of Knoxville.

The personnel of the Tennessee Engineering & Sales Company is: J. C. Buchanan, formerly with the Knoxville Power & Light Company; W. L. Tadlock, formerly with the General Electric Company, and S. E. Adcock, formerly with C. M. McClung & Company and the Acme Electric Company of Knoxville.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., manufacturer of wiring devices, is placing on the market a line of white vitrified porcelain devices for old house work where loom boxes and the "BX" type surface boxes are used frequently. These devices with short chain and cord, insulated chain and the keyless type are all fitted with a 2¼-in. porcelain shade holder. They may also be used with switch boxes or 3¼-in. and 4-in. outlet boxes.

The Pioneer Storage Battery Company, 244 North Fifteenth Street, Philadelphia, Pa., is arranging for the early occupancy of a new plant at 1341-47 Brandywine Street, for the manufacture of electric storage batteries and kindred products. The present works will be removed to the new location and the capacity considerably increased.

The Wetmore-Savage Company, Boston jobber, announces that it has acquired the business of the E. H. Ham Company, Worcester, and will conduct it as a branch house with a full line of general electrical supplies and equipment under the original personnel.

The Pittsburgh Electric Furnace Corporation, Thirty-second and Putney Streets, Pittsburgh, has received a contract from the Saginaw Malleable Iron Foundries of the General Motors Corporation for a battery of "Moore Rapid Lectromelt" malleable iron furnaces having a capacity of 24 tons per hour. This new equipment will effect an enlargement of the Saginaw company's malleable iron foundry. This is said to be the first large malleable iron foundry to be fitted out with chain type, continuous molding tables and electric furnaces.

The Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland, has appointed J. B. Howard, 398 Newbury Street, Boston, as its New England sales representative.

The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, manufacturer of "Union" and "Gem" fuses and "Union" outlet and "Gem" switch boxes, announces the removal of its Philadelphia office from the Weightman Building to 517 Packard Building.

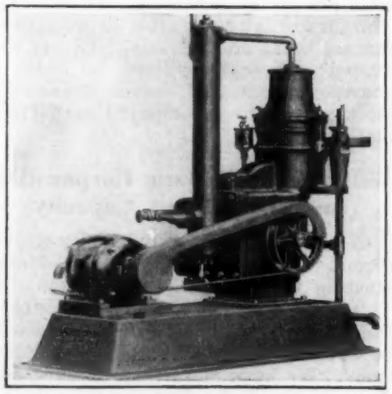
The Western Electric Company has recently opened a new supply distributing house at Hackberry and Duval Streets, San Antonio, Tex. The building covers an area of 20,000 sq.ft.

The Sibley-Pitman Electric Corporation, Sixth Avenue and Thirteenth Street, New York, jobber, announces the following additions to its sales force: N. S. Harris, who will specialize on central-station companies and industrial firms, H. L. Mulligan, who will follow up important electrical contractors and general construction work, and A. L. Paulhus, who will be assigned to the lower Manhattan district. Mr. Harris for the last four years has been central-station specialist with the Edison Electric Appliance Company, Mr. Mulligan for the past two years has been national field representative on conduit products for the merchandise department of the General Electric Company, and Mr. Paulhus was formerly a specialist in the wiring device section of the merchandise department of the General Electric Company at Bridgeport.

New Equipment Available

Oil Dehydrator

For drying transformer oil at one pass, providing a dehydrating and purifying action, an apparatus known as the "Hydroil" has been placed on the market by the Hydroil Sales Corporation, Lebanon, Ind. It has been especially designed and built for the sole purpose of dehydrating and purifying transformer and switch oil.



COMPLETE HYDROIL UNIT ON BEDPLATE READY FOR INSTALLATION

The distinctive feature of the Hydroil is the universal bowl. In addition to the usual disks, which divide the fluid into thin layers for more rapid separation, the Hydroil is equipped with a perforated cylinder, forming a sediment zone, and a skirted dividing cone, which effects an automatic adjustment between the oil and water columns. When a mixture of oil, water and solid impurities enters the bowl, the separation is said to be so perfect that only pure oil of high dielectric test flows from the oil discharge, and water only flows from the water discharge. The solid matter is retained in the sediment zone. If only water is supplied to the machine, nothing will emerge from the oil discharge, and, if only pure oil is supplied, nothing will come from the water discharge.

The Hydroil as now built is especially intended to be permanently installed in central stations and substations where the transformer equipment is 1,000 kva. or over. Where the machine is used infrequently in any one location it is arranged for portable use.

New Trade Literature

POLYPHASE MOTORS.—Bulletin No. 38 issued by the Century Electric Company, St. Louis, covers the Century type "SC" squirrel-cage induction polyphase motors. It contains a description of various parts of the motor and also calls attention to the Century 'Wool-Yarn" system of fractional-horsepower-motor lubrication. These motors are manufactured in sizes from ¼ hp. to 75 hp.

STREET LIGHTING. — "Planning and Judging Street Lighting" is the title of bulletin GEA-66, issued by the General Electric Company, Schenectady, N. Y., which outlines plans for various types of street-lighting installations. It offers recommendations for the proper intensity of illumination for different classes of streets. Illustrations showing typical lighting installations are included.

PORTABLE INSTRUMENTS. — The Weston Electrical Instrument Company, Newark, N. J., has issued bulletin No. 501-F, covering the Weston portable instruments for direct current, including voltmeters, megohm voltmeters, volt-ammeters, milliammeters, and microammeters, etc. The company is distributing a folder describing the new Weston model 506 radio panel voltmeter.

ENGINEERING DATA AND WIRE TABLES.—The Copperweld Steel Company, Braddock P. O., Rankin, Pa., is distributing a revised edition of its "Engineering Data and Wire Tables" on Aristos "Copperweld" wire as messenger, guy and trolley-span wire.

BUS SUPPORTS.—The Electrical Development & Machine Company, Philadelphia, is distributing bulletin No. 600 covering its "Franklin" type "I" bus supports. Bulletin No. 700 issued by the company describes and illustrates the "Franklin" type "T" bus supports. Attention is called to the standardization of these bus supports to take universally interchangeable top hardware.

POLE SUPPORTS AND ANCHORS.—The Blaw-Knox Company, Pittsburgh, Pa., is distributing the "Malone" pole support and the "Malone" guy anchor, which are designed to reinforce wood poles that have rotted at the ground line. It contains a drawing showing the construction and information covering the installation of the guy anchor and pole support.

GROUNDING APPLIANCES. — The Groundulet Company, Newark, N. J., is distributing price list No. 6 covering its various types of "Groundulets," "Groundit" bushings, "Groundits" for water pipes and driven grounds and "Groundit" meter shunts.

SPEED RECORDING AND INDICATING INSTRUMENTS. — The Esterline-Angus Company, Indianapolis, Ind., is distributing bulletin No. 725, in which it describes and illustrates its speed recording and indicating instruments. It also contains two drawings, one showing a section of a record from a speed record on a paper machine, and the other showing the principal dimensions of the generator and the diagram of connections.

TURBINE BLOWERS.—The L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City, has issued bulletin No. 77 covering its turbine blowers. It contains illustrations showing various types of its turbines, other interesting information, including data relative to the application of these blowers to stokers, and graphical representation of their use for hand-fired boilers.

ELECTRIC CAR-PULLER. — Bulletin No. 129 issued by the Mead-Morrison Manufacturing Company, East Boston, Mass., describes the Mead-Morrison electric car puller. Illustrations are given showing typical installations and also a list of industries using the car puller.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Tegucigalpa, Honduras (No. 15,992), for electric pumps for water systems for farms.

Purchase is desired in Coblenz, Germany (No. 15,997), of vulcanizing apparatus and accessories.

Purchase and agency is desired in Stockholm, Sweden (No. 16,065), for carbon electrodes.

Purchase is desired in Palermo, Italy (No. 16,006), of small engine-driven electric plants.

Purchase and agency is desired in Nassau, Bahamas (No. 16,007), for electric household devices and pumping plants.

Purchase is desired in Madrid, Spain (No. 16,009), of radio apparatus.

Purchase and agency is desired in Tokyo, Japan (No. 16,010), for radio apparatus.

Purchase is desired in Copenhagen, Denmark (No. 16,012), of radio apparatus.

Purchase is desired in Prague, Czechoslovakia (No. 16,011), of sheets for transformer laminations and telephone diaphragms.

Purchase is desired in Melbourne, Australia (No. 15,989), of telephone supplies (No. 16041), of forging machines, pneumatic hammers, including motor tools, and compressed air or steam hammers.

Purchase is desired in Port Limon, Costa Rica (No. 16,008), of variable resistance for controlling 110-volt direct current for moving-picture circuit.

Purchase and agency is desired in Cologne, Germany (No. 16,050), for passenger and freight elevators.

Purchase and agency is desired in Augsburg, Germany (No. 16,051), for high-duty machine tools, milling, drilling and shaping machines and lathes and precision tools.

Purchase and agency is desired in Nassau, Bahamas (No. 16,007), for small pumping plants.

Purchase and agency is desired in Riga, Latvia (No. 16,038), for brass, copper, steel, tin, lead and spelter; rods, tubes, etc.

Purchase is desired in Bombay, India (No. 16,026), of 200 tons per month of copper sheet.

Purchase is desired in Buenos Aires, Argentina (No. 16,081), of glass protective screens for X-rays.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SOMERVILLE, MASS.—Work has begun on the assembling works of the Ford Motor Company, Detroit, to be located at East Somerville. The plans include an electric power house, to be equipped to use oil fuel. The cost of the project is estimated at $2,000,000. Albert Kahn, Marquette Building, Detroit, is architect.

TAUNTON, MASS.—Two plans are under consideration for extensions to the municipal electric plant, one is to install an additional generating unit in the municipal plant and the other to connect up with the Montaup Company, Fall River. Jacksom & Moreland, are consulting engineers.

WORCESTER, MASS. — Arrangements are being made by the New England Power Company for the construction of another automatic hydroelectric plant on the Deerfield River in Massachusetts at Sherman Bridge, near the Massachusetts-Vermont state line. The plans provide for a development of 6,000-kva., to cost about $1,600,000. Specifications for machinery are now being prepared.

Middle Atlantic States

BUFFALO, N. Y. — The Washburn-Crosby Manufacturing Company, Minneapolis, Minn., flour miller, plans to install electric power equipment at its proposed grain elevator on Michigan Street, to cost about $225,000.

CENTER VILLAGE, N. Y.—The Binghamton Light, Heat & Power Company has applied for permission to take over the property of the Afton-Windsor Light, Heat & Power Company, Inc., and merge it with its system. The former company proposes to erect a transmission line from Binghamton through Dickinson, Fenton, Kirkwood and Colesville, to connect with the local system. After the line is completed the local water plant will be maintained as an auxiliary.

DICKINSON, N. Y.—The Binghamton Light, Heat & Power Company plans to erect a transmission line from Binghamton to Dickinson, Kirkwood, Colesville and vicinity to furnish electrical service.

LACKAWANNA, N. Y.—The installation of an ornamental lighting system on Roland, Kirby and Gates Avenues and on Warsaw and Clinton Streets is under consideration by the City Council.

MOUNT VERNON, N. Y.—Plans for the proposed laundry of the Lenox Laundry Company, 23 North Third Street, to cost about $150,000, include a power plant. Francisco & Jacobus, 511 Fifth Avenue, New York City, are architects and engineers.

NEW YORK, N. Y.—Bids will be received by the New York State Bridge and Tunnel Commission and New Jersey Interstate Bridge and Tunnel Commission, 3004 Woolworth Building, New York City, until Sept. 8 for furnishing ventilating and transformer fans with necessary motor, control and transmission for each, and installing this equipment in the New York and New Jersey ventilation buildings, known as contract No. 12 of the Holland Tunnel. For details see Searchlight Section.

PHILADELPHIA, N. Y.—Improvements are contemplated to the municipal electric light and power plant, to cost about $35,000. W. T. Field, Watertown, is consulting engineer.

SACKET HARBOR, N. Y.—Plans for the proposed local biscuit factory to be erected by the Imperial Biscuit Company, at a cost of about $60,000, include a power house.

STRATFORD, N. Y.—Plans are under way by the Utica (N. Y.) Gas & Electric Company to extend its lighting system from Pine Crest Sanatorium, Salisbury to Stratford, a distance of 4 miles, to furnish service here. The cost is estimated at about $8,000.

NEWARK, N. J.—A permit has been granted to the Public Service Electric Company to erect a substation at 111 Clay Street, to cost about $40,000.

PATERSON N. J.—The Cramer & King Company, East Thirty-third Street, plans to build a power house at its textile works, to cost about $36,000.

EMAUS, PA.—The City Council plans to install an oil engine-driven electric generating unit, etc. in connection with a proposed municipal waterworks, for which bids will soon be asked.

MIQUON, PA.—The W. C. Hamilton Paper Company plans to build a steam-driven electric plant at its mill, the surplus power to be sold to the Counties Gas & Electric Company. The present steam-driven apparatus in the paper mill will be replaced with electric equipment.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 11, for two electric arc welding equipments (Schedule 4126).

PINE GROVE, PA.—Extensions are contemplated by the East Penn Electric Company, Pottsville, to its local electric plant, to cost about $300,000.

PITTSBURGH, PA.—The Hoffman Lumber Company, 7,900 Division Street, contemplates building a power house in connection with its proposed lumber mill in the Homewood district.

SALISBURY, MD.—Bids will be received by the Salisbury Water and Sewer Commission until Aug. 20 for furnishing and installing pumping station equipment, contract No. 9, which will include six centrifugal pumps (1,000 to 2,500 gallons per minute) and motors to drive same; switchboard and appurtenances, motor controls and station wiring; suction and discharge piping, gauges, gauge boards and eductor; two venturi meters with instruments, and low service centrifugal pump priming system. Francis H. Dryden is chief engineer.

UNION BRIDGE, MD. — The Potomac Edison Company, Cumberland, has acquired a controlling interest in the Union Bridge Electric Manufacturing Company, and contemplates extensions in transmission system for service in this section.

HUNTINGTON, W. VA.—The installation of an ornamental lighting system on West Pike Street from Angle Inn to the West Fork River is under consideration.

HUNTINGTON, W. VA.—Plans for the proposed lumber mill to be built in Mingo County by the Northeast Lumber Company, Robson-Pritchard Building, to cost about $100,000, include a power plant.

COEBURN, VA.—The City Council is considering taking over the plant of the Coeburn Utility & Manufacturing Company.

VIRGINIA BEACH, VA.—The installation of an ornamental lighting system on

Atlantic Avenue is under consideration by the Council.

WASHINGTON, D. C.—The Potomac Electric Power Company contemplates an expenditure of $17,000 for placing its wires underground.

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, Washington, until August 17, for 900 direct-current voltmeters (Circular CAS 7).

WASHINGTON, D. C.—The Potomac Terminal Company plans to install electric power equipment at its proposed freight terminal on Maryland Avenue, to cost about $1,000,000.

North Central States

CALUMET, MICH.—The Calumet & Hecla Mining Company contemplates the purchase of four electrically-driven hoists for mining purposes.

CORUNNA, MICH.—The Consumers Power Company, Jackson, Mich., plans to build a local substation, of about 12,000 hp. capacity.

DETROIT, MICH.—The Paige Motor Car Company, McKinstry and Fort Streets, West, plans extensions to its power house, including the installation of additional equipment.

MARQUETTE, MICH.—The installation of a 1,250-hp. oil engine-driven generating unit at the municipal waterworks is under consideration by the Water Department.

MUSKEGON, MICH.—Bids, it is reported, will soon be asked by the Shaw Walker Company, for remodeling its power house. The cost is estimated at $50,000. Woodmansee-Davison Engineering Company, Chicago, is engineer.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 14 for lead-covered cable for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 14 for furnishing valves and boiler mountings for the Department of Utilities.

COLUMBUS, OHIO.—Property owners on East Gay Street have petitioned the City Engineer for the installation of ornamental lamps on that thoroughfare.

LONDON, OHIO.—The Williams Steel Wool Company plans to build a power house in connection with the rebuilding of its plant, recently destroyed by fire, with a loss of about $60,000.

OXFORD, OHIO.—The municipal electric plant has been acquired by the Union Gas & Electric Company, Cincinnati.

BICKNALL, IND.—Extensions are contemplated to the municipal water-works, including the installation of pumping equipment.

JASPER, IND.—Extensions to the municipal electric plant, including the installation of additional equipment is under consideration by the Council. Charles Brossman, Merchants' Bank Building, Indianapolis, is engineer.

METZ, IND.—The Lake Shore Power Company, Toledo, Ohio, which is negotiating for the property of the Metz Light & Power Company, and for the system of the Hamilton Mill Company, plans extension to its transmission lines in this section.

NEW CASTLE, IND. — Arrangements have been made by the Chrysler Motor Company with the Interstate Public Service Company, Indianapolis, for energy, (1,500 hp.) for service at its local car factories. In order to provide this service the company plans to build a substation here, and erect a 66,000-volt line to connect with the transmission system of the Indiana Electric Corporation, near Knightstown. The cost of the project is estimated at $150,000.

CHICAGO, ILL.—A permit has been granted to the Commonwealth Edison Company to construct an addition to its power plant on Crawford Avenue, to cost about $238,000. Sargent & Lundy, Chicago, are engineers.

FAIRFIELD, ILL.—Bonds to the amount of 150,000 have been authorized for improvements to the waterworks system. The present plans provide for motor-driven pumps.

PRAIRIE DU CHIEN, WIS.—Tentative plans are being considered by the City Council for establishing a municipal electric plant.

RACINE, WIS.—The erection of a transmission line from Plymouth north through Appleton and Green Bay to Niagara, connecting the system of the Peninsular Power Company is under consideration by the Wisconsin Gas & Electric Company.

ELKADER, IOWA.—Plans have been announced by the Northeastern Iowa Power Company for the construction of another power unit at its local plant on the east side of the river and remodeling of the dam to develop more power. Improvements to the equipment are also contemplated.

OTTUMWA, IOWA.—The local properties of the Northern States Power Company, Chicago, have been acquired by the Iowa Southern Utilities Company, Centerville, which plans to erect a 66,000-volt transmission line from Ottumwa to Newton to connect with the lines of the Des Moines Electric Company and the Washington line.

GREAT BEND, KAN.—Surveys are being made by the Great Bend Water & Electric Company for the erection of a 33,000-volt transmission line from Great Bend to Hoisington, a distance of 12 miles. Substations of 600 kva. capacity will be built in Great Bend and Hoisington.

Southern States

CRAMERTON, N. C. — The Wateree Power Company, a subsidiary of the Southern Power Company, Charlotte, contemplates the construction of a dam and bridge across the South Fork River, near Cramerton, for regulating the flow of the river at that location.

ATLANTA, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 25 for installing new controllers, etc., for two electric passenger elevators at the United States post office and court house at Atlanta, Ga. For details see Searchlight Section.

HOMERVILLE, GA.—The City Council contemplates the installation of a municipal electirc lighting plant.

MEIGS, GA.—The municipal electric plant has been acquired by the Georgia-Alabama Power Company, Albany, which plans to erect a transmission line from Pelham, 5 miles long, and build a substation here.

DINSMORE, FLA.—Plans for the proposed local textile mill to be erected by the Hashba Textile Company, recently organized, at a cost of about $1,000,000, include a power plant.

POMPANO, FLA.—Application has been made by the Pompano Electric Light & Power Company for an electric light franchise. The company contemplates the installation of additional equipment and extension of its lines, to cost about $75,000.

ST. PETERSBURG, FLA.—Steps have been taken by the Johns' Pass Road Improvement Association for the installation of an ornamental lighting system on Thirtieth Avenue.

TAMPA, FLA.—Plans for the proposed local cement mill to be built by a new company now being organized by John L. Senior, president, the Signal Mountain Portland Cement Company, James Building, Chattanooga, Tenn., and associates, to cost about $3,500,000, include a power plant. The Cowham Engineering Company, Chicago, is engineer.

ETOWAH, TENN.—At an election to be held Aug. 11, the proposal to issue $200,000 in bonds to establish a municipal electric plant and waterworks system, will be submitted to the voters.

TREZEVANT, TENN.—The City Council plans to build a substation and electric distributing system. Electricity will be supplied by the Kentucky-Tennessee Light & Power Company, Guthrie, Ky., which plans extension to its transmission lines in this section.

EUFAULA, ALA.—Plans for the proposed local textile mills to be erected by the Gloria Underwear Mills, Inc., Reading, Pa., at a cost of about $200,000, include a power plant.

HAZLEHURST, MISS.—The municipal electric plant has been acquired by the Mississippi Power & Light Company, Jackson.

DANVILLE, ARK.—Plans are under consideration by the Danville Light Company for extensions and improvements in its electric power plant, including the installation of additional equipment. The company also contemplates an addition to its ice manufacturing plant.

HEADRICK, OKLA.—The Southwestern Light & Power Company, Lawton, has been granted a franchise to furnish electricity here. A high-tension transmission line will be erected from Tipton to Headrick to furnish the service.

AMARILLO, TEX.—The water and electric plants of the City Light & Power Company have been acquired by the Southwestern Public Service Company, Roswell, New Mex.

HOUSTON, TEX.—The Houston, Beaumont & Orange Interurban Company plans to build a number of substations in connection with a proposed interurban line to Orange, about 125 miles. W. J. Dougherty, Houston, is president.

NEDERLAND, TEX. — The Eastern Texas Electric Company, Beaumont, plans to build a steam-operated electric power plant here.

Pacific and Mountain States

LONGVIEW, WASH. — The Longview Public Service Company is building an indoor automatic substation of 1,500 kva. capacity, erecting four lighting and one power feeders, 2,300 volts, three phase, 60 cycles. C. M. Allen is superintendent.

SALEM, ORE.—The Western Paper Converting Company, recently organized by E. A. O'Neill of the Oregon Pulp & Paper Company, plans to build a power house at its proposed local mill, to cost about $175,000.

ANTIOCH, CAL.—Plans are being prepared by the Pacific Gas & Electric Company, San Francisco, for the erection of a substation in Antioch, to cast about $250,000.

CHICO, CAL.—The Pacific Gas & Electric Company, San Francisco, has authorized the reconstruction of its Chico-Inskip and Volta-Inskip transmission lines, Red Bluff district, to carry at 60,000 volts.

FRESNO, CAL.—The San Joaquin Light & Power Corporation has been granted permission to use water from Wilson and Moorhouse Creeks, tributaries of the Middle Fork of the Tule River, Tulare County, for a proposed hydro-electric power development. The cost is estimated at $11,500,000, including transmission system.

LOS ANGELES, CAL.—The City Council is considering the installation of ornamental lamps on Seneca, Revere and Croft Avenues, and Alfred Street, using concrete standards; and Fifty-fourth Street, using pressed steel standards.

LOS ANGELES, CAL.—Petitions have been filed by the Wilshire Boulevard Association and West Wiltshire Association with the traffic and lighting committee of the City Council for the installation of a copyrighted lamp post on Wilshire Avenue, from Westlake Park to Fairfax Avenue.

MONTEREY, CAL.—The City Council is considering the installation of ornamental lamps the entire length of Alvarado Street, using metal standards. H. D. Severance is city engineer.

RED BLUFF, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to build a substation on Monroe Street, to cost $50,000.

RIVERSIDE, CAL. — Plans have been prepared by the Southern Sierra Power Company for the construction of a hydro-electric power station on Lake Sabrina, to develop 7,500 hp.

CLIFTON, ARIZ.—Bids, it is reported, will be asked about Sept. 15 by W. H. Rosecranz, architect, 108 South La Salle Street, Chicago, for the construction of a hydro-electric plant at Clifton for the Commonwealth Power & Light Corporation of Arizona. The cost of the project is estimated at about $2,000,000, and will include a dam 1,000 ft. long, and 100 ft. high, 6 miles of wood stave pipe line, and about 50 miles of steel tower transmission line.

HARLEM, MONT.—The system of the Harlem Citizen's Electric Company has been acquired by the Montana Power Company, Butte. Extensions and improvements, including a transmission line from Chinook to the Milk River Valley district are contemplated.

Canada

VICTORIA, B. C.—Application has been made by the British Columbia Electric Railway Company to the Dominion Department of Public Works for permission to erect a high-tension line across the second narrows, Victoria, for which specifications are being prepared. The cost is estimated at $60,000.

CAMPBELLFORD, ONT.—Bonds to the amount of $400,000 have been authorized by the Quinte & Trent Valley Power Company, Ltd., Toronto, the proceeds to be used for the purpose of developing water power at Frankford and Campbellford on the Trent River. The plans provide for a development of 4,000 hp. to be distributed in the Trent Valley, covering a radius of 35 miles. Kerry & Chace, Ltd., Confederation Life Building, Toronto, are consulting engineers.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 30, 1925)

1,544,202. SYSTEM FOR PRODUCING OSCILLATIONS; W. C. White, Schenectady, N. Y. App. filed Jan. 20, 1921. In a radio-transmitting system.

1,544,212. PERFUME VAPORIZER; J. G. Blaschke, Hot Springs, Ark. App. filed Oct. 30, 1923.

1,544,227. APPARATUS FOR ELECTRODEPOSITION OF PRECIOUS ORES; W. R. Dodge, Timmins, Ontario, Canada. App. filed Nov. 26, 1923.

1,544,236. PORTABLE ELECTRIC LIGHT; W. D. Kahn, West Orange, N. J., and G. A. Thomson, Newark, N. J. App. filed April 7, 1922. Dry-cell type.

1,544,272. METHOD OF AND APPARATUS FOR PRODUCING HIGH FREQUENCY ELECTRIC WELDS; D. F. Pancoast, Cleveland, Ohio. App. filed Dec. 11, 1924.

1,544,281. ELECTRIC FIXTURE; P. W. Sprecher, Milwaukee, Wis. App. filed Jan. 23, 1925.

1,544,294. ELECTRIC LIQUID HEATER; J. Dykmans, Brussels, Belgium. App. filed Jan. 16, 1924.

1,544,300. AUTOMATIC TELEPHONE SYSTEM; C. J. Erickson, Chicago, Ill. App. filed Sept. 7, 1920.

1,544,301. SPRING TERMINAL CLIP; A. P. Fahnestock, Long Island City, N. Y. App. filed June 6, 1923.

1,544,314. CONTROLLER ACTUATING DEVICE; M. W. Hanks, Madison, Wis. App. filed Oct. 19, 1922. To control the operation of food-cooking ovens.

1,544,321. NEGATIVE RESISTANCE DEVICE; A. W. Hull, Schenectady, N. Y. App. filed July 5, 1919. Vacuum tube.

1,544,330. AUTOMATIC TELEPHONE SYSTEM; F. T. Madsen, Chicago, Ill. App. filed June 30, 1919.

1,544,333. ELECTRIC TIME SWITCH; W. B. Marks, Waterbury, Conn. App. filed March 1, 1924.

1,544,357. ELECTROLYTIC PROCESS; C. J. Thatcher, New York, N. Y. App. filed April 2, 1923. For preparing a plurality of products, particularly organic products, by one electrolysis.

1,544,371. PLURAL LAMP SOCKET; A. L. Buschman, New York, N. Y. App. filed Jan. 10, 1925.

1,544,379. MAGNETIC RECORDER; F. L. Dyer, Montclair, N. J. App. filed Feb. 16, 1921.

1,544,381. METHOD AND SYSTEM FOR AMPLIFYING VARIABLE CURRENTS; G. W. Elmen, Bogota, N. J. App. filed April 9, 1919.

1,544,422. WELDING ROD; F. M. Beckert, New York, N. Y. App. filed Nov. 3, 1922.

1,544,436. WIRE SUPPORT; H. E. Easterday, Martinsburg, W. Va., and W. H. Kennedy, Bedington, W. Va. App. filed Sept. 14, 1922. For supporting a plurality of wires in proper spaced relation.

1,544,437. TELEPHONE REGISTER; D. S. Ellis, Newtown, New South Wales, Australia. App. filed Feb. 24, 1923. Automatic.

1,544,446. ELECTRIC SWITCH; G. W. Goodridge Fairfield, Conn. App. filed June 22, 1923. Of the "feed-through" type.

1,544,474. ELECTRIC SWITCH; A. H. Nero, New Britain, Conn. App. filed Aug. 2, 1921. For lamp sockets.

1,544,502. IRON; N. B. Thomas and O. N. Smith, Logansport, Ind. App filed Nov. 22, 1921.

1,544,508. ARRANGEMENT FOR GENERATING HIGH FREQUENCY ENERGY; G. von Arco, Berlin, Germnay. App. filed Aug. 3, 1922.

1,544,517. ELECTRIC FOUR-WHEEL AUTOMOBILE TRANSMISSION; J. M. Conklin, Bell, Cal. App. filed Dec. 12, 1923.

1,544,528. ELECTRICAL DEHYDRATOR FOR PETROLEUM EMULSIONS; H. C. Eddy, Los Angeles, Cal. App. filed Oct. 19, 1923.

1,544,536. CONTROL SYSTEM FOR ELECTRIC SWITCHES; G. E. Stewart, Philadelphia, Pa. App. filed April 17, 1924. That are automatically operated.

(Issued July 7, 1925)

1,544,549. THERMOSTATIC INSTRUMENT; S. G. Barnett, New York, N. Y. App. filed April 14, 1922. Compensating thermostat useful in detecting rapid temperature variations.

1,544,551. PANELBOARD; R. B. Benjamin, Chicago, Ill. App. filed June 14, 1920.

1,544,554. CAUTERY AND HOLDER; W. J. Cameron, Chicago, Ill. App. filed April 11, 1923.

1,544,563. ELECTRICALLY HEATED FLATIRON; L. C. Doane, East Cleveland, Ohio. App. filed Feb. 10, 1923. With temperature automatically maintained.

1,544,604. SWITCH HOUSING STRUCTURE; W. M. Scott, Tredyfrin Township, Chester County, Pa. App. filed Aug. 30, 1921.

1,544,605. ELECTRODEPOSITION OF METALS; H. A. Sedgwick and P. J. Sheehan, Milwaukee, Wis. App. filed June 27, 1921.

1,544,622. ELIMINATION OF INTERFERENCE IN CARRIER SYSTEMS; H. A. Affel, Brooklyn, N. Y. App. filed May 10, 1924.

1,544,634. ELECTRIC WALL SWITCH; G. Corzan-Avendano, Budapest, Hungary. App. filed Nov. 14, 1924.

1,544,638. TELEGRAPH SIGNALING SYSTEM; J. M. Fell, Hackensack, N. J. App. filed July 12, 1921.

1,544,647. TELEPHONE APPARATUS FOR THE DEAF; M. J. Johnson, Naugatuck, Conn. App. filed April 29, 1924.

1,544,695. MAGNETIC HOLDING DEVICE; H. J. Spencer, Watertown, Mass. App. filed May 16, 1921.

1,544,719. ART OF ELECTRIC WELDING; A. R. Braden, Beverly, Mass. App. filed Feb. 10, 1923.

1,544,726. ELECTROLYTIC REFINING OF METALS; F. F. Colcord, New York, N. Y. App. filed Aug. 28, 1924.

1,544,737. ELIMINATION OF INTERFERENCE IN CARRIER SYSTEMS; E. I. Green, East Orange, N. J. App. filed May 10, 1924.

1,544,746. METHOD AND APPARATUS FOR CONTROLLING WATER CRAFT FROM AIRCRAFT; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 10, 1916.

1,544,772. BATTERY OPERATED LANTERN; C. Osean, Woodcliff, N. J. App. filed April 17, 1923.

1,544,780. APPARATUS FOR AND METHOD OF OPERATING DYNAMO-ELECTRIC MACHINES; H. Schoemaker, Jersey City, N. J. App. filed Aug. 27, 1919. For generating and applying power for shop propulsion.

1,544,785. RENEWABLE FUSE; G. R. Trumbull, Bantam, Conn. App. filed Aug. 24, 1921.

1,544,786. MICROPHONE; W. L. Walker, New York, N. Y. App. filed April 22, 1922. For the reception of submarine sound signals.

1,544,825. TERMINAL DEVICE; J. M. Fitz-Gerald, River Forest, Ill. App. filed Dec. 16, 1921.

1,544,831. WIRE-SPLICING DEVICE; J. B. Glowacki, Chicago, Ill. App. filed April 24, 1922.

1,544,832. SWITCHING MECHANISM FOR LAMP SOCKETS; W. B. Goddard, Palo Alto, Cal.

1,544,838. OZONE GENERATOR; H. B. Hartman, Scottdale, Pa. App. filed Aug. 25, 1923.

1,544,846. AUTOMATIC TELEPHONE EXCHANGE; F. A. Lundquist, Chicago, Ill. App. filed March 28, 1921.

1,544,848. ELECTRIC THERAPEUTIC DEVICE; O. Melby, Eugene, Ore. App. filed Dec. 19, 1922.

1,544,852. TOILET CASE; S. E. Miller, Chicago, Ill. App. filed Nov. 5, 1923. Using a dry-cell light.

1,544,860. COUNTING APPARATUS; G. B. Reisbach, Milwaukee, Wis. App. filed Sept. 22, 1919. For use with high-speed newspaper presses.

1,544,865. GASEOUS CONDUCTION ELECTRIC HEATER; O. Schaller and F. Schroter, Berlin, Germany. App. filed March 16, 1921.

1,544,871. TELAUTOGRAPH; G. S. Tiffany, Summit, N. J. App. filed Oct. 25, 1918.

1,544,886. LAMP; E. W. Bryce, Pittsburgh, Pa. App. filed May 9, 1922. Portable.

1,544,900. ELECTRIC-ARC LAMP; E. Giese, Berlin, Germany. App. filed Sept. 26, 1922. With heated-wire regulation.

1,544,910. REPEATER FOR MULTIPLEX SYSTEMS; B. W. Kendall, New York, N. Y. App. filed Oct. 31, 1919.

1,544,919. POLARIZED RELAY; D. J. McCarthy, Elgin, Ill. App. filed May 29, 1920.

1,544,921. AMPLIFIER CIRCUITS; R. C. Mathes, New York, N. Y. App. filed Nov. 12, 1919. For telephone system.

1,544,926. SIGNALING SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed April 6, 1920. Telegraph system.

1,544,939. SIGNALING SYSTEM; J. C. Schelleng, East Orange, N. J. App. filed Nov. 24, 1922. Telegraph system.

1,544,943. ELECTRIC WAVE REPEATER FOR MULTIPLEX TRANSMISSIONS; E. O. Scriven, New York, N. Y. App. filed Sept. 27, 1919.

1,544,958. TELEPHONE EXCHANGE SYSTEM; E. F. Trapp, Valley Stream, N. Y. App. filed May 19, 1924. Testing system for use in machine-switching offices.

1,544,989. POWER FACTOR INDICATOR; S. James, Birmingham, England. App. filed Dec. 8, 1923.

1,545,015. METHOD FOR MEASURING CROSS TALK; E. Schurer, Cologne-Mulheim, Germany. App. filed March 28, 1922. On telephone system.

1,545,019. SWITCH FOR ELECTRIC ENGINE STARTERS; G. Steiner, Solothurn, Switzerland. App. filed April 24, 1922.

1,545,025. AUTOMATIC TELEPHONY; P. A. Anspach, Brussels, Belgium. App. filed Sept. 19, 1923.

1,545,040. MULTIPLYING TRANSFORMER; W. Dornig, Berlin-Steglitz, Germany. App. filed May 10, 1923. Frequency multiplying.

1,545,041. CIRCUIT ARRANGEMENT FOR FREQUENCY MULTIPLYING TRANSFORMERS; W. Dornig. App. filed May 10, 1923.

1,545,064. TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Dec. 23, 1918. Automatic.

1,545,066. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Edison Park, Ill. App. filed Sept. 15, 1919.

1,545,078. RECORDING METER; D. J. Angus, Indianapolis, Ind. App. filed Jan. 19, 1925.

1,545,079. HEATER; J. Barlow, Chicago, Ill. App. filed Aug. 22, 1923. Auxiliary to a heating plant.

1,545,101. ELECTRIC-LIGHTING DEVICE; F. Hodous, Minneapolis, Minn. App. filed Dec. 13, 1922. Portable light; for detachably securing in a convenient position on the back of the hand.

1,545,110. ELECTRICALLY HEATED FLATIRON; E. Stranszky, Warren, Pa. App. filed Dec. 8, 1921. With temperature automatically regulated.

1,545,131. TRANSFORMER COVER; J. H. Dillon, H. H. Fairweather, and E. I. Palmer, Coatesville, Pa. App. filed Jan. 16, 1925.

1,545,153. RELAY AND AMPLIFIER; J. T. McDermott, Worcester, Mass. App. filed Dec. 27, 1921. For telephone and telegraph circuits.

1,545,174, 1,545,175. DYNAMO ELECTRIC MACHINE; W. A. Turbayne, Niagara Falls, N. Y. App. filed July 20, 1915. Capable of operation as a double-circuit generator.

1,545,183. TELEPHONE SYSTEM; E. E. Clement, Washington, D. C. App. filed June 5, 1905. Semi-automatic.

1,545,197. CABLE SPLICE; H. Prince, Buffalo, N. Y. App. filed Jan. 13, 1923.

1,545,202. ELECTRIC CIGAR AND PIPE LIGHTER; W. S. Rugg, Pittsburgh, Pa. App. filed Dec. 1, 1922.

1,545,207. ELECTRICAL APPARATUS; C. G. Smith, Medford, Mass. App. filed Aug. 30, 1920. Involving electrical circuits which include a gaseous medium as part of the circuit, as a vacuum tube.

1,545,213. ELECTRIC MOTOR; H. R. Stuart, Springfield, Ohio. App. filed June 26, 1924. Repulsion-induction type.

1,545,238. CURRENT COLLECTOR AND GUIDE; G. H. Dein, Brooklyn Manor, N. Y. App. filed May 27, 1922. For use in railless trolley systems.

1,545,247. SUPPORT FOR VACUUM TUBES; J. O. Gargan, Brooklyn, N. Y. App. filed Oct. 17, 1919.

1,545,256. PROCESS OF MANUFACTURING ELECTRON EMITTING CATHODES; C. D. Hocker, East Orange, N. J. App. filed Sept. 5, 1918.

1,545,268. ELECTROPLATING APPARATUS; C. G. Miller, Chicago, Ill. App. filed March 28, 1924.

1,545,270. SECRET CARRIER WAVE SIGNALING SYSTEM; H. W. Nichols, Maplewood, N. J. App. filed Nov. 19, 1920.

1,545,276. SELECTING MECHANISM; H. Pfannenstiehl, Maplewood, N. J. App. filed Nov. 16, 1921. Manually controlled type; used in telephony.

1,545,280. TRAIN SIGNALING SYSTEM; H. Rowntree, Kenilworth, Ill. App. filed Aug. 3, 1917.

1,545,301. TELEGRAPHY COMBINED WITH PROTOTELEGRAPHY OR TELAUTOGRAPHY; H. G. Bartholomew and M. L. D. McFarlane, London, England. App. filed Jan. 19, 1925.

1,545,313. ATTACHMENT PLUG; G. W. Goodridge, Fairfield, Conn. App. filed May 12, 1924.

1,545,383, 1,545,384, 1,545,385. APPARATUS FOR ELECTROLYZING FUSED SALTS; E. A. Ashcroft, London, England. Apps. filed April 10, 1922, May 7, 1923, and Feb. 5, 1924.

1,545,413. ELECTROTHERAPEUTIC GLOVE; G. W. Elmvall, New York, N. Y. App. filed Sept. 27, 1923.

1,545,423. ELECTRICAL APPARATUS; J. A. Harlan and F. F. Starr, Dayton, Ohio. App. filed March 31, 1923. System of electrical generation and battery charging.

1,545,431. PROTECTIVE DEVICE FOR SAME TIME CLOCKS; D. C. Jamopoulo, St. Louis, Mo. App. filed May 14, 1924.

Financial and Corporate

Utility Market Irregular

Middle West Utilities Leads in Its Spectacular Jump of Twenty-five Points

THE market in power and light stocks was more of an irregular affair in the week under review than it had been in several weeks, although for the most part the gains and losses were relatively modest. Continuation of easy money is a favorable influence in the market, but the belief grows that slightly firmer rates will prevail this autumn. Consequently bankers are beginning to scrutinize their collateral for loans somewhat more carefully.

In the unlisted market the outstanding feature of the week unquestionably was the spectacular rise in Middle West Utilities shares. The advance from below 100 to nearly 125 in a week was the sharpest improvement ever shown in so short a time by the Middle West issue. It resulted from accumulation by people who have been impressed with the substantial growth in the holding company's earnings. United Light & Power "A" shares also took another upturn on persistent rumors that another important group soon is to be added to the system. The stock closed the week more than eight points higher.

Losses of modest proportions were sustained by the General Gas & Electric Company issues and by such stocks as Carolina Power & Light, Commonwealth Power, Georgia Light, Power & Railways, Northern States Power and Southern California Edison. Gains, on the other hand, were achieved in the unlisted group by American Light & Traction, National Public Service "A" and Power Corporation of New York.

Active trading continued in North American Company's common stock on the big board, but little change was recorded in the price that appeared on the tape. Other issues that are attracting attention now on the big board are the newly listed Utilities Power & Light "A" and Standard Gas & Electric Company's stock.

New Capital Issues

To finance the consolidation of the West Virginia properties, acquisition of which was announced in last week's issue of the ELECTRICAL WORLD, to retire bonds and for other corporate purposes, the Monongahela West Penn Public Service Company made an offering of first lien and refunding mortgage gold bonds, series B, totaling $13,200,000.

There were also offered during the first week of August 50,000 shares of preferred stocks of Electric Investors, Inc., at $95 and accrued dividends per share, to yield over 6.30 per cent. The company was organized last fall to acquire and hold securities of public utility companies as diversified permanent investments, and its management is identified with that of the Electric Bond & Share Company. The International Utilities Corporation was represented with an issue of 25,000 shares of cumulative preferred stock, the price being $95 per share, to yield 7.36 per cent, and the National Electric Power Company with a two-million-dollar issue of 7 per cent cumulative preferred stock.

Two offerings made on Friday, July 31, too late to include in the table entitled, "Security Issues of Electric Service Companies in July," published in last week's issue of the ELECTRICAL WORLD, were an issue of Eastern Texas Electric Company's three-year gold notes to the amount of $4,000,000 and an issue of first mortgage thirty-year sinking-fund gold bonds of the Quinte & Trent Valley Power Company, a Canadian organization, to the amount of $400,000.

Bonds Called in August

Among the electric light and power bonds called for payment in August in advance of maturity are the following:

Entire Issues	Due	Amount
Monongahela West Penn Public Service 6's	1928	$8,605,700
Consolidated Gas, Elec. Lt. & Pwr. of Baltimore 6½'s	1951	8,532,500
Oklahoma Gas & Electric B 6's	1941	7,000,000
Oklahoma Gas & Electric A 7½'s	1941	6,750,000
Oklahoma Gas & Electric cv. 8's	1931	2,090,500
Great Western Power B 7's	1950	5,107,100
Niagara, Lockport & Ontario Power 6's	1958	3,948,300
U. S. Public Service 6's	1927	2,530,400
Intermountain Ry., Lt. & Pwr. 6's	1942	798,000
Galveston-Houston Electric 8's	1926	250,000
Not Entire Issues	**Due**	**Amount**
Great Consolidated Electric Power, Ltd., 7's	1944	250,000
United Electric sec. 5's	1936	122,000
Philadelphia Co 6's	1944	89,800
Springfield (Ohio) Light, Heat & Power 5's	1929	25,000

Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of June:

Name of Company:	Gross Earnings for June—1925	1924
American Water Wks. & Elec.	$3,268,978	$3,024,790
Binghamton Lt., Ht. & Pwr.	124,328	107,514
Blackstone Val. Gas & Elec.	374,150	343,887
Columbus Elec. & Power	204,123	167,548
Eastern Texas Electric	217,853	198,000
Edison Electric Illuminating	121,467	107,952
Electric Power & Light	2,925,194	2,755,068
Federal Light & Traction	441,949	417,146
Florida Public Service	74,925	61,455
Idaho Power	257,616	249,837
Kansas City Power & Light	750,584	718,801
Metropolitan Edison	657,770	632,039
Mississippi River Power	280,525	270,516
Nevada-California Electric	705,080	679,511
New Bedford Gas & Ed. Lt.	308,411	255,297
New England Co. Power Sys.	616,420	498,266
New Jersey Power & Light	96,772	80,487
North Carolina Pub. Service	148,402	138,968
Northern Texas Electric	194,005	208,785
Pennsylvania Edison	228,665	238,365
Puget Sound Pwr. & Light	991,176	979,267
Sayre Electric	20,857	16,062
Sierra Pacific Electric	95,228	90,450
Southern California Edison	2,194,901	2,045,110
Southern Canada Power	96,110	81,986
Utah Power & Light	768,798	708,777
Washington Water Power	455,360	417,446
West Penn	2,015,789	1,983,682

New Japanese Loan Floated

A syndicate headed by the Guaranty Company of New York and including Dillon, Read & Company, Lee Higginson & Company and Harris, Forbes & Company offered during the past week an issue of three-year 6 per cent gold notes of the Tokyo Electric Light Company, Ltd. The financing involved a total of $24,000,000. The proceeds of these notes, priced at 98¾ and interest to yield over 6.40 per cent, will be used to pay the company's entire existing bank indebtedness and to provide funds for its construction program.

The Tokyo Electric Light Company, established in 1886, is the largest electric power and light company in Japan, owning electric generating stations with an aggregate installed capacity of 280,757 kw. and operating within an area of approximately 9,375 square miles with a population of more than 9,000,000. This is the fourth Japanese electric company to enter the American market for funds, the Toho Electric Power Company, the Great Consolidated (Daido) Electric Power Company and the Ujigawa Electric Power Company, Ltd., having previously sold securities in the United States.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company:	Per Cent	When Payable
Brooklyn Edison	2	Sept. 1
Buffalo, Niagara & Eastern Power	.12½	Oct. 1
Consolidated Gas of N. Y.	$1.25	Sept. 15
Cumberland Co. Pwr. & Lt., pf.	1¾	Aug. 1
Duquesne Lt., 1st pf.	1¾	Sept. 15
Los Angeles Gas & Elec., 6% pf.	1½	Aug. 15
Newport News & Hampton Railway, Gas & Electric	1¾	Oct. 1
Philadelphia Co., 5% pf.	$1.25	Sept. 1
Tampa Electric	2½	Aug. 15
White (J. G.) Co., pf.	1¾	Sept. 1
White (J. G.) Engineering, pf.	1¾	Sept. 1
White (J. G.) Management, pf.	1¾	Sept. 1
English Electric Co. of Canada, pf.	2½	Aug. 15
International Combus. Engineering	.50	Aug. 31
Kelvinator Corporation	.37½	Aug. 20

Listings.—The New York Stock Exchange has authorized the listing of temporary interchangeable stock certificates of the Louisville Gas & Electric Company of Delaware on official notice of issuance in exchange for present outstanding interim receipts for 495,724 shares of class A common stock without par value, with authority to add 30,556 shares on official notice of issuance in exchange for outstanding preferred stock at the ratio of four shares of class A common for each share of preferred stock. There have also been listed on the exchange additional $500,000 first refunding mortgage gold bonds, 7 per cent series, of the Manila Electric Company and $800,000 first lien refunding mortgage gold bonds, series B, 6 per cent, of the Portland Electric Power Company; 132,997 additional shares of common stock with-

out par value of the Public Service Corporation of New Jersey, and 153,750 shares of class A stock without par value of the Utilities Power & Light Corporation, with authority to list 35,000 additional shares on official notice of issuance and payment in full. The Boston Stock Exchange has authorized the listing of 104,600 additional preferred shares and 1,227,600 common shares of the Commonwealth Power Corporation, $675,000 additional first mortgage 6 per cent gold bonds, series B, of the Florida Public Service Company, interim receipts of the Great Consolidated Electric Power Company of Japan, Ltd., for $13,500,000 first and general mortgage 6½ per cent sinking fund gold bonds and the temporary certificates for 12,000 shares of class A common stock of the Southwestern Light & Power Company.

Adirondack Tells Story of Its Growth

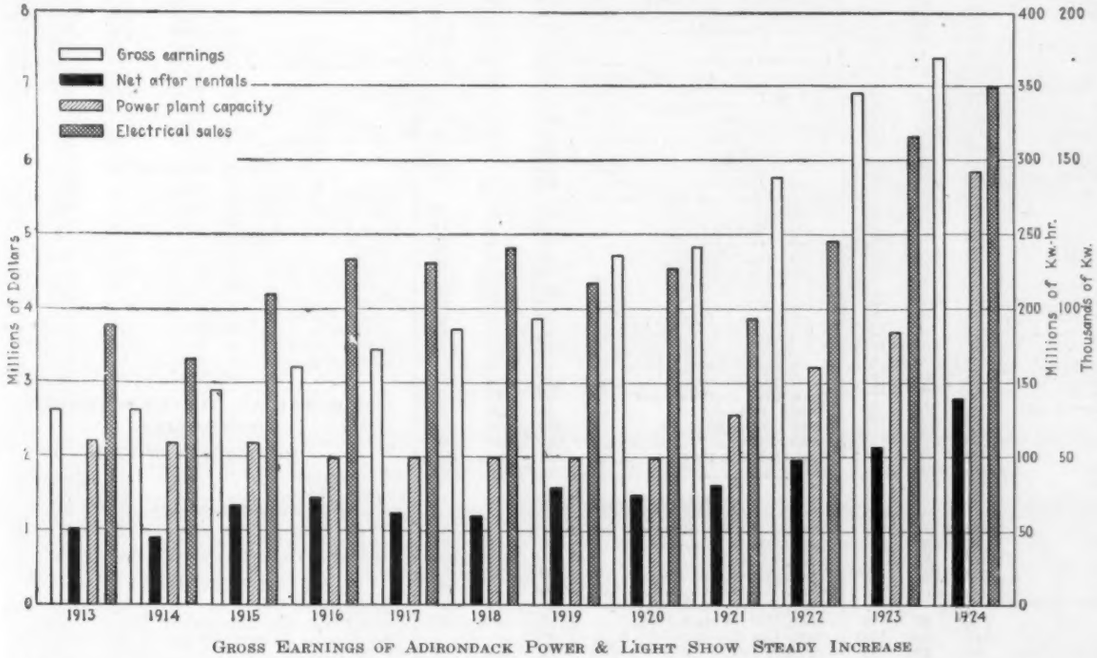
Annual Report of Adirondack Power & Light Corporation Traces History of Utility Since Original Charter Was Granted in 1886

BY PAUL WILLARD GARRETT

THE Adirondack Power & Light Corporation's annual report for 1924, which has just been published, is a report, a history of the utility from its earlier days and a year book all in one. The document illustrates the tendency among many leading power and light companies nowadays to popularize their statements. Within four years the Adirondack has increased the number of its stockholders alone from 1,000 to 9,000 and for that reason sees advantage in the addition of such features as charts, pictures and a map to illustrate certain developments not apparent always from an examination of the income account and balance sheet.

Insull, Church, Byllesby and Kerr are among the names prominent in the industry that at one time were identified with these earlier companies. The Adirondack today in general serves the area between Albany on the south, Syracuse on the west and Lake Champlain on the north.

Adirondack Power & Light has connections for the interchange of power with all companies operating in its general territory and supplies power to others which do not operate in that territory. At the end of 1924 the company had 64,604 electric customers supplied with power at wholesale and retail, a figure that represents an increase of 11 per cent over the year before and 57 per cent over 1920. Total electric sales were 349,430,510 kw.-hr., a 10 per cent increase over a year ago and 54 per cent over 1920.



GROSS EARNINGS OF ADIRONDACK POWER & LIGHT SHOW STEADY INCREASE

The corporation's greatest development has come, of course, since 1920, when the present organization was completed by the merger of two large companies that were operating in the valley of the upper Hudson River and in the Mohawk Valley; but the charter of the present company dates back to 1886. No fewer than forty predecessor companies have gone into the formation of the present Adirondack Power & Light Corporation. Westinghouse,

That the company has undertaken to raise funds on a large scale for its future development is attested by the fact that since 1920 it has issued $22,461,100 par value of securities, of which virtually the entire amount has been new money. This brings us to a consideration of the present capital structure. Correcting the December 31, 1924, figures to allow for changes made up to February 28, 1925, Adirondack's mortgage bonds totaled $23,846,000 and its debenture bonds $5,394,100, or $29,240,000 altogether in bonds. Total stock outstanding is about $20,601,500, of which roughly half is preferred and half is common.

The Adirondack management has plowed enormous earnings back into the property for years in order to make the utility independent of fluctuations in rainfall for development of power, and for that reason earnings in past years have not reflected the full benefits of the investment. That the company rapidly is getting to a point where these benefits may be realized, and that it also is greatly benefited by growth of its territory, are apparent on an examination of the income account. Gross earnings have risen steadily, from $2,614,544 in 1913 to $7,400,816 for 1924, and net earnings from $1,025,517 to $2,468,871 in the same period. The rise to parity in the common shares of the Adirondack Power & Light Corporation in the last year from a level of about 30 has been one of the more spectacular recoveries in the utility list and has, of course, accompanied merger developments as well as improved earnings.

Southeastern Power Reports Increased Income. — The report of the Southeastern Power & Light Company for 1924, issued last week, shows gross income from all sources of $9,810,829, an increase of $1,188,909 over the preceding year, while net income before bond interest and charges was $4,911,649, a gain of $845,234. After all deductions and preferred stock dividends there remained a balance for the common stock and surplus of $1,058,954. These figures include the Alabama Traction, Light & Power Company, Ltd. The Southeastern Power & Light was formed last September and acquired stocks and securities of the Alabama Power Company and other allied companies in Alabama from the Alabama Traction, Light & Power Company, Ltd. Demand for electric light and power in the territory served by the Alabama Power Company continued to increase and the output was the largest in the history of the company. Additions and improvements made to the Alabama Power Company's system during 1924 amounted to $8,837,333.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

PREFERRED STOCKS

Operating Companies

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Adirondack Pwr. & Lt.—7%	100	98	106
Adirondack Pwr. & Lt.—8%	108	103	115
Appalachian Pwr.—7%	98	92	100
Appalachian Pwr. 1st pf.—7%	100	95	101
Arizona Pwr.—7%	79	75	87
Arkansas Lt. & Pwr.—7%	98	92	102
Asheville Pwr. & Lt.—7%	98	101	102½
Central Ill. Pub. Serv.—6%	85	84	93
Cleveland Elec. Illg.—6%	102	101	105
Colo. Pwr.—7%	95	93	98
Conn. Lt. & Pwr.—8%	115	115	118
Conn. Lt. & Pwr. —7%	106	105	110
eCon. Gas, El. Lt. & Pwr.—6%	110	105	110¼
Cons. Gas, El. Lt. & Pwr.—8%	124	123	126
Cons. Gas, El. Lt. & Pwr.—7%	109	108	112
Consumers' Pwr.—6%	94	90	97
Dayton Pwr. & Lt.—6%	94	88	100
Dubuque Elec.—6%	89	80	90
Duquesne Lt.—7%	f110	105	111¾
East. Tex. Elec.—6%	100	100	105
Empire Dist. Elec.—6%	78	78	85
Ft. Worth Pwr. & Lt.—7%	f102	101½	103
Georgia Ry. & Pwr.—4%	90	62	90
Gt. West. Pwr.—7%	g101	....	....
Ia. Ry. & Lt.—7%	97	92	100
Ill. North. Utilities—6%	88	82	92
Ill. Pwr. & Lt.—7%	95½	92½	98
Interstate Pub. Serv.—7%	97	90	100
Kans. Gas & Elec.—7%	f104	101½	103
Long Island Lighting—7%	104	100	105
Los Angeles Gas & Elec.—6%	96	90	97
Milwaukee Elec. Ry. & Lt.—8%	100	98	105
Milwaukee Elec. Ry. & Lt.—7%	97½	96	105
Milwaukee Elec. Ry. & Lt.—6%	87	83½	87
Minn. Pwr. & Lt.—7%	f100	100	101
Miss. River Pwr.—6%	92	87½	94
Nebraska Pwr.—7%	f102½	102	103½
N. J. Pwr. & Lt.—7%	101	92	98
New Orleans Pub. Serv.—7%	100½	94	102
N. Y. Central Elec.—7%	98½	96	100
Niagara Falls Pwr.—7%—25	28½	28	29
Niagara, Lock. & Ont. Pwr.—7%	107	101½	110
No. Caro. Pub. Serv.—$7—no par	91	90	96
No. Ohio Trac. & Lt.—6%	73	64	75
North. States Pwr.—7%	99	95	100
Ohio Gas & Elec.—7%	90	87	100
Ohio Pwr.—6%	92	85	95
Ohio Pub. Serv.—7%	98	97	100
Pac. Gas & Elec.—6%	98	92	99
Pac. Pwr. & Lt.—7%	f101½	101	102½
cPenn Central Lt. & Pwr.—no par	69	60	69½
Penn-Ohio Pwr. & Lt.—7%	96	91	100
Penn-Ohio Pwr. & Lt.—8%	104	101	110
Penn. Pub. Serv.—7%	90	90	100
Penn Pub. Serv.—6%	80	80	90
Penn. Pwr. & Lt.—$7—no par.	f103½	103½	104½
cPhila. Elec.—8%—25	38¼	37½	45
Portland Elec. Pwr.—7%	98	95	99
Portland Elec. Pwr.—6%	72	70	80
Pwr. Corp. of N. Y.—7%	98	96	102
Pub. Serv. of No. Ill.—6%	108	90	97
Pub. Serv. of Okla.—7%	94	87	95
Pub. Serv. Elec. & Gas—6%	f 95¾	92½	95¾
Puget Sound Pwr. & Lt.—7%	102	102½	107
Rochester Gas & Elec.—5%	105	80	98
So. Calif. Edison—8%	125	115	128
So. Calif. Edison—7%	109	105	107½
So. Calif. Edison—6%	95	90	95½
Tenn. Elec. Pwr.—6%	85	80	85
Tenn. Elec. Pwr.—7%	98½	93	103
Tenn. Elec. Pwr.—$6—no par	81	72	84
Tex. Pwr. & Lt.—7%	f102½	102	104
Toledo Edison—8%	110	109	114
Toledo Edison—7%	100	94	101½
Utah Pwr. & Lt.—7%	f100½	100	101½
Utica Gas & Elec.—7%	101	100	104
Vermont Hydro-Elec.—7%	90	87	96
Virginia Pwr.—7%	102	94	107
West Penn—7%	96¾	94	100
West. States Gas & Elec.—7%	89	82	92
Wis.-Minn. Lt. & Pwr.—7%	90	92	95
Yadkin River Pwr.—7%	f102	102	103

Holding Companies

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Amer. & Foreign Pwr.—7%	f 90½	87	94
Amer. Elec. Pwr.	104	96	104½
Amer. Gas & Elec.—6%—no par	90	85	91
Amer. Lt. & Trac.	101	93	101½
Amer. Pwr. & Lt.—6%	93	84	91½
Amer. Pub. Serv.—7%	90	88	94
Amer. Pub. Utilities—5%	79	71	82
Amer. Pub. Utilities—7%	90	87	95
Amer. Water Wks. & Elec.—6%	104	95½	110¼
Amer. Water Wks. & Elec.—7%	f 98½	98	103
Assoc. Gas & El.—7%—1% extra—50	f 52	....	....
Assoc. Gas & Elec.—$6—no par	84	....	....
Carolina Pwr. & Lt.—$7—no par	105	100	107
Central Ark. Ry. & Lt.—7%	97	91	98½
Central Ind. Pwr.—7%	90	88	95
Central States Elec.—7%	93	87	98
Cities Serv.—6%	83	80	84
Columbia Gas & Elec.—7%	107½	104¼	110½
Commonwealth Pwr.—6%	82	80	85½
Continental Gas & Elec.—7% pfc. pf.	94	85	97
Continental Gas & Elec.—7% pr. pf.	92½	89	95
Elec. Bond & Share—6%	f104	104	106
Elec. Investors—7%	99	90	100
Elec. Pwr. & Lt., etfs.	f 91½	90	94
Elec. Pwr. & Lt., etfs. 40% pd.	f108½	100	110
Galveston-Houston Elec.—6%	68	70	75
Gen. Gas & Elec.—6%	225	72	240
Gen. Gas & Elec.—7%	150	120	....
Gen. Gas & Elec.—$7—no par	150	90	175
Gen. Gas & Elec.—$8—no par	165	104½	180
Georgia Lt., Pwr. & Rys.—6%	80	74	85
Jersey Central Pwr. & Lt.—7%	97	90	96
aMiddle West Utilities—7%	98½	91½	98¾
Middle West Utilities—pr. lien 7%	103	98	108
Natl. Lt., Ht. & Pwr.—5%	62	40	65
Natl. Pwr. & Lt.—$7—no par.	99	95	99
No. Amer.—6%—50	f 49¾	46½	50½
No. Tex. Elec.—6%	55	60	75
Penn-Ohio Elec.—7%	94	83½	96
Phila. Co.—50	48¾	45½	49
Pub. Serv. Corp. of N. J.—7%	101½	99	102½
Pub. Serv. Corp. of N. J.—8%	114	108¾	115½
Southeastern Pwr. & Lt.—7%	97	90	100
Southern Cities Utilities—7%	87	77	100
Southwestern Pwr. & Lt.—7%	100	90	102
Standard Gas & Elec.—8%	f 54¾	50½	54¾
Standard Gas & Elec.—7%	99	96	100
Standard Pwr. & Lt.—7%	112	95	114½
United Gas & Elec.—5%	92	80	94
cUnited Gas Improv.—50	90½	79½	96½
United Lt. & Pwr.—$4—no par	50	41	51
United Lt. & Pwr.—$6.50—no par	87	83	99
Western Pwr. Cor.—7%	93	84	95½

COMMON STOCKS

Operating Companies

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Adirondack Pwr. & Lt.—50	94	31	98
Appalachian Pwr.—no par	79	70	83
Arizona Pwr.	29½	15	33
Arkansas Lt. & Pwr.	100	65	101
Brooklyn Edison	f138½	120¼	140¾
Buffalo Gen. Elec.	70	44	73½
Cleveland Elec. Illg.	240	200	250
aCommonwealth Edison	137	130½	141¾
cConsol. Gas, Elec. Lt. & Pwr.	44½	32	45
Dayton Pwr. & Lt.	420	180	460
Detroit Edison	f130	110	134½
Eastern Tex. Elec.	70	70	75½
dEdison Elec. Illum. of Boston	207	200	213
Georgia Ry. & Pwr.	98	62	99
aKy. Hydro.-Elec.	92	85½	92½
Long Is. Light	105	60	105
Miss. River Pwr.	64	37	68
Montana Pwr.	f 87½	64	89½
New Orleans Pub. Serv.—no par	33	31	38½
Niagara Falls Pwr.—no par	62	45½	77
Niagara, Lock. & Ont. Pwr.—no par	65	60	73
North. Ohio Pwr.	11½	5	13½
North. States Pwr.	120	103	125
North. Tex. Elec.	40	40	70
Pacific Gas & Elec.	f116½	102½	118½
cPenn. Wtr. & Pwr.	160½	126½	165
cPhila. Elec.—25	38½	37½	47⅜
Portland Elec. Pwr.	42	40	53
Pwr. Corp. of N. Y.—no par	81	15	89½
Pub. Serv. Co. of No. Ill.	118	97	124
Puget Sound Pwr. & Lt.	53	49	61
So. Calif. Edison	129	102	139
Tenn. Elec. Pwr.—no par	60	47	69
Toledo Edison	25	21	25
Utica Gas & Elec.	200	100	200
Virginia Pwr.	66	65	92
Virginia Ry. & Pwr.	f123½	64½	123½
West Penn	f116	105	145

Holding Companies

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Amer. & Foreign Pwr.—no par	f 41	27¼	47
Amer. Gas & Elec.—no par	79	70	85
Amer. Lt. & Trac.	181	139	189
Amer. Pwr. & Lt.	59	52	67
Amer. Pub. Serv.	85	45	90
Amer. Public Utilities	95	70	103
Amer. Wtr. Wks. & Elec.	f 63½	34¾	68½
Assoc. Gas & Elec., Class A	f 44½	....	....
Carolina Pwr. & Lt.—no par	420	290	430
Central States Elec.	115	70	102
Cities Service (new)	38½	34	43
Columbia Gas & Elec.—no par	f 74¾	45¾	74¾
Commonwealth Pwr. Corp—no par	155	106	173
Cons. Gas—no par	f 89¾	74½	92¾
Continental Gas & Elec.	125	77	99
Elec. Bond & Share Sec.	f70	69½	71¾
Elec. Investors	63½	30	66
Elec. Pwr. & Lt., etfs.	f 37	17¼	40½
Federal Lt. & Trac.	f 31½	30	36
Galveston-Houston Elec.—no par	20	32	40
General Gas & Elec.	225	72	240
Georgia Lt., Pwr. & Rys.	69	25	74
Georgia Ry. & Pwr.	98	62	99
Jersey Central Pwr. & Lt.	40	15	50
Lehigh Pwr. Securities—no par	145	82	131
aMiddle West Utilities—no par	109½	82½	110
aNational Elec. Pwr.	95½	94½	96¾
Natl. Lt., Ht. & Pwr.	11	11	....
Natl. Pwr. & Lt.—no par	343	185	357
No. Amer.—10	f 58	41½	60¾
Phila. Co.—50	f 62	51½	62
Pwr. Securities—no par	13	....	....
Pub. Serv. Corp. of N. J.—no par	f 85¾	62⅜	85⅞
Republic Ry. & Lt.	64	49	65
Southeastern Pwr. & Lt.	146	45	158
Southern Cities Utilities	58	30	71
Standard Gas & Elec.—no par.	f 59½	40¼	59¾
United Gas & Elec. (Conn.)—no par	47	26	49
United Lt. & Pwr.—A—no par	126	42	127
United Lt. & Pwr.—B—no par	115	49	100
Western Pwr. Corp.—no par	59	34	68

BONDS

Operating Companies

Companies			Bid Price Saturday, Aug. 1	Low 1925	High 1925
Adir. Pwr. & Lt.	6s	1950	104	102½	105¼
Ala. Pwr.	5s	1946	99	96	100
Appalachian Pwr.	5s	1941	97½	96	99¼
Brooklyn Edison	5s	1949	101	99½	103
	6s	1930	104½	103¼	105½
Cleveland Elec. Illum.	5s	1939	101½	100	102
Com'wealth Edison.	5s	1943	101¾	99½	102¼
	5s	1953	99	98¼	101
eConsol. Gas Elec. Lt. & Pwr.	5½s	1952	104¾	102¼	105¼
Consumers' Pwr.	5s	1936	99½	99	100¼
	5s	1952	95¾	90¾	100
Detroit Edison.	5s	1933	101¼	99¼	102½
Duquesne Lt.	6s	1949	106	104¾	107¼
Great Western Pwr.	5s	1946	97¼	95	99¼
Kansas City Pwr. & Lt.	5s	1952	98½	95⅝	101
Miss. River Pwr.	5s	1951	99	96½	100¼
Montana Pwr.	5s	1943	99	97⅜	100¾
New Eng. Pwr.	5s	1951	102	100¾	103
N. Y. Edison	6½s	1941	114½	112	115½
Niagara Falls Pwr.	6s	1932	106	103¾	106½
No. States Pwr.	5s	1941	95¾	93	99½
No. States Pwr.	6s	1941	105⅝	103	107¼
Ohio Pwr.	7s	1951	106½	106¼	107¼
Pacific Gas & Elec.	5s	1942	95¾	93¾	99
Penn. Wtr. & Pwr.	5s	1940	100½	100	100¼
cPhil. Elec.	5s	1966	102½	100½	103¼
	5½s	1947	106	103¾	107
	6s	1941	106½	106	108¾
Portland Elec. Pwr.	6s	1947	99¾	96½	100
So. Cal. Edison.	5s	1939	99	99¼	101
	6s	1944	103¾	102½	105½
Tenn. Elec. Pwr.	6s	1947	102½	99¼	104½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Toledo Edison.	7s	1941	105¾	108¾	110
Utah Pwr. & Lt.	5s	1944	94¼	91	98½

Holding Companies

Companies			Bid Price Saturday, Aug. 1	Low 1925	High 1925
Ala. Trac. Lt. & Pwr.	5s	1962	97	86	97½
Amer. Gas & Elec.	6s	2014	98	96½	98½
Amer. Pwr. & Lt.	6s	2016	96½	94	98
Am. Wtr. Wks. & Elec.	5s	1934	95¾	92½	98
Assoc. Gas & Elec.	6½s	1954	f102¾	....	....
Central Ind. Pwr.	6s	1947	98	95½	99¼
Commonwealth Pwr.	6s	1947	102½	97⅜	103½
Consol. Cities Lt., Pwr. & Tr.	5s	1962	80	75½	82½
Ill. Pwr. & Lt.	6s	1953	101	100½	102½
United Lt. & Rys.	5s	1932	95	93¼	97½
	6s	1952	98½	95¾	100½

ELECTRICAL MANUFACTURING COMPANIES

PREFERRED STOCKS

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Allis-Chalmers Mfg.	105½	103¼	108
bWagner Elec.	g 79¾	79	91
West. Elec. Instrument—A	f 24¾	19⅜	26⅞
Western Elec.—7%	114	113¾	117½
Worthington Pump & Mach.—A	75	79	88
Worthington Pump & Mach.—B	64½	65	76¾

COMMON STOCKS

Companies	Bid Price Saturday, Aug. 1	Low 1925	High 1925
Allis-Chalmers Mfg.	f 82	71½	86½
Amer. Bosch Magneto—no par	f 30½	26½	54½
Elec. Storage Battery—no par	f 67½	60¾	70¾
General Elec.	f308	227½	320
General Elec.—10	f 11½	11	11⅞
aHurley Machine—no par	47½	41½	56
Timken Roller Bearing	f 44	37⅜	46½
bWagner Elec.	30¾	26½	50
Westghse. Elec. & Mfg.—50	f 73½	66½	84
West. Elec. Instrument	f 14½	9¼	17½
Worthington Pump & Mfg.	f 41	36¼	79¼

BONDS

Companies			Bid Price Saturday, Aug. 1	Low 1925	High 1925
General Elec.	3½s	1942	87	83	86
	5s	1952	107⅜	101½	107¾
Robbins & Myers	7	1952	62½	62½	73½
Wagner Elec. Mfg.	7s	....	100½	100½	102
Western Elec.	5s	1944	100½	98	101
Westghse. Elec. & Mfg.	7s	1931	106¼	106½	108½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore. fBid price, low and high, Tuesday, Aug. 4. gLatest quotations available.